

STRUCTURE OF THIS MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use this microcard	1	2	3	4
A01 = Structure of microcard			SIS	
B01 = Trouble-shooting chart	A-***X*	X*XXX	XXXXX	XXXXX *XXXX X
	B-*XXXX	XXXXX	XXXXX	XXXXX XXX
	C-XXXXX	XXXXX	XXXXX	XXXXX XXX
	D-XXXXX	XXXXX	XXXXX	XXXXX XXX
	E-XXXXX	XXXXX	XXXXX	XXXXX XX
	F-XXXXX	XXXXX	XXXXX	XXX
	G-XXXXX	XXXXX	XXXX	
	H-			
	J-			
	K-			
	L-			
	M-			
N01 = Service information	N-*XXXX	XXXXX	XXXXX XXX	*X XX*
	12345	67890	12345 67890	12345 678
		1	2	
			Index	

N28 = Table of contents and publication information

- 1 = Special features
- 2 = Safety and precautionary measures
- 3 = Testers and tools
- 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each micropicture).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

Beginning	Mid-section	End	One-page section
-----------	-------------	-----	------------------

A01		=> <=
-----	--	-------

HOW TO USE THIS MICROCARD

System: Motronic M 1.2

Descriptions, photographs, terminal designations and special features refer to the following vehicle:

BMW 750i with 5.0 l / 12-cylinder engine,
year of manufacture 10.87->

These basic instructions represent detailed trouble-shooting instructions. They are not to be used as vehicle-specific instructions. Important! Descriptions and photos may differ from the vehicle-specific brief instructions.

Binding set values, terminal assignments and special features are to be taken exclusively from the vehicle-specific brief instructions. Refer to Microcard KFZ-00.. for brief instructions.

NOTE :

On account of the two Motronic control units (see Section "Special features") the self-diagnosis test table and the self-diagnosis trouble-shooting program always feature two flashing codes (to distinguish between Motronic, right and left).

In the trouble-shooting program numerous tests refer to only one system component (e.g. engine-speed/reference-mark sensor, right or left).

For fault elimination, the stated tests and measurements are always to be performed on the components connected to the corresponding control unit.

The test is always to be performed on both systems if it is not possible to clearly establish the system in which the fault is to be found.

A02		=> <=
-----	--	-------

SPECIAL FEATURES

*Two Motronic systems M 1.2 with self-diagnosis:

The V 12 engine is controlled by two Motronic control units and one electronic-accelerator-pedal control unit.

One Motronic control unit in each case controls one cylinder bank and is independent of the other Motronic control unit.

All important system components such as air-mass meter, engine-speed/reference-mark sensor, Lambda sensor, tank ventilation valve, high-tension sensor, temperature sensor for coolant (2 sensors or one twin sensor) and intake air, fuel pump, pressure regulator, main relay and pump relay are thus doubled up.

Motronic 1: cyl.1...6 (right-hand cylinder bank in direction of travel, with cyl.1 at front).

Motronic 2: cyl.7...12 (left-hand cylinder bank in direction of travel, with cyl.7 at front).

The synchronization of the cylinder banks and idle-speed regulation and the provision of the "idle" and "full load" information are effected by the electronic-accelerator-pedal control unit, thus obviating the need for an idle actuator and throttle-valve switch.

*Control units with 55-pole plugs.

*Variant encoding in the control units for adaptation to different types of fuel, to country versions, to the type of transmission and to vehicle models etc.

*Group injection: breakdown of each injection bank into 2 groups which inject at different times.
Group 1: cylinders 1,3,5 or 7,9,11.
Group 2: cylinders 2,4,6 or 8,10,12
Recognition by way of sensor on high-tension cable, cylinder 6 or 12.

*Adaptive Lambda closed-loop control and tank ventilation with pulsed valves.

SPECIAL FEATURES (CONTINUED)

*The two Motronic control units are identical. In order to distinguish between the Motronic right and left when interrogating the self-diagnosis (both with tester and by way of flashing code), terminal 40 is connected to ground on the control unit for the left-hand cylinder bank.

Terminal 40 on the control unit for the right-hand cylinder bank is open.

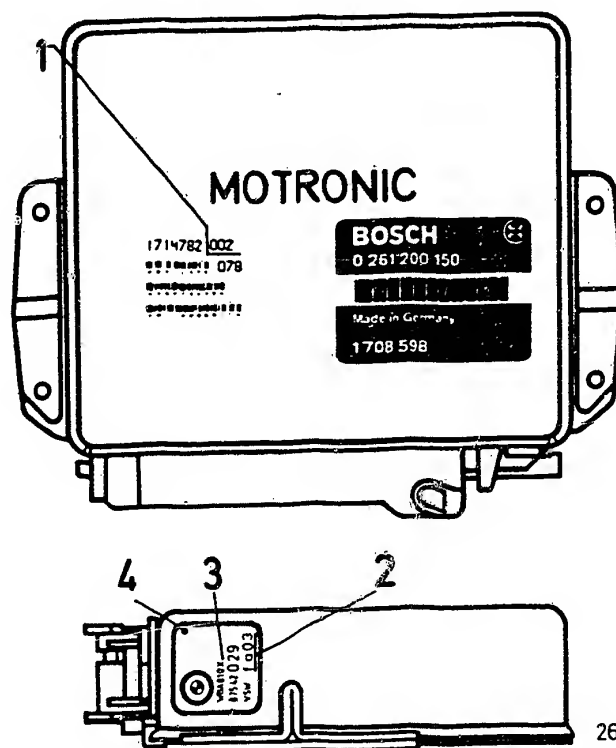
*There is a difference in the activation of the flashing-code output of the two control units. Refer to Section "Self-diagnosis", Coordinate B05 for further details.

*Important information concerning trouble-shooting on 750i up to year of manufacture approx. 06.88: Terminal 23 of the Motronic 2 control unit is not configured due to the fact that there is only one sensor-heater relay (connected to terminal 23 of the Motronic 1 control unit). This generally leads to fault storage by the Motronic 2 (left) because an open circuit is recognized. This fault is not to be taken into consideration when performing trouble-shooting!

Variant-encoded Motronic control units

The desired variant is to be activated in a basic control unit, so as to be able to adapt the engine to various types of transmission, to model series, to different country versions and to various grades of fuel, as well as to further special versions.

This measure is intended to reduce the number of different types of control unit.



261/557

- 1 = Growth number, 3-digit
- 2 = Variant control word, 4-digit, alphanumeric
- 3 = Chassis number
- 4 = BMW sticker

SPECIAL FEATURES (CONTINUED)

The control-unit model must be programmed by KH to the specific vehicle type prior to delivery to the BG/BD.

Note: The engine won't run if use is made of uncoded control units. Incorrectly coded control units can lead to engine damage.

The coding/programming can only be performed by KH. For this purpose, KH requires not only the 10-digit part number for the basic control unit, but also further information which is to be taken from the built-in control unit (see picture).

The following information must be given when ordering:

1. Part number, 10-digit as before
2. Growth number, 3-digit (001 to 999)
3. Variant control word, 4-position, alphanumeric.

Example: 1. 0 261 200 150
2. 002
3. C05E

Delivery procedure:

+The variant-coded control units are carried at KH as central stock parts.

+Delivery by overnight despatch (within the Federal Republic of Germany) directly to the orderer.

+Delivery is extended by one day due to the necessary programming of the control units at KH.

SPECIAL FEATURES (CONTINUED)

Tank ventilation system

Lambda-controlled vehicles are equipped with a closed tank-ventilation system (see basic diagram).

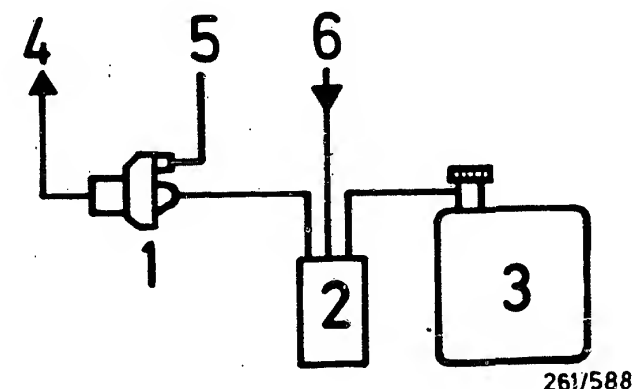
The fuel vapours produced in the fuel tank are stored in the active-carbon filter. When the engine is running, it draws off the fuel vapours. Two pulsed tank ventilation valves, which are installed between the active-carbon filter and the two manifolds, meter the fuel vapours fed in.

In line with the operating status of the engine, the Motronic control units regulate the opening cross-section of the tank ventilation valves by way of a duty cycle. This avoids an excessive change in the mixture.

When no current is being applied, i.e. when the ignition is switched off, the tank ventilation valves are open. In order to prevent after-dieseling, the tank ventilation valves drop out with a time delay when the ignition is switched off. This is made possible by the hold circuits in the control units.

Hold circuit

The main relay (negative side via term.85) is deenergized with a time delay by the control unit as a result of the hold circuit. This means that the control unit remains active until shortly prior to switch-off of the ignition, so as to be able to supply the tank ventilation valve with voltage until the engine is stopped and thus to keep it closed.



- 1 = Tank-ventilation valve
- 2 = Activated-carbon filter
- 3 = Fuel tank
- 4 = To intake manifold
- 5 = Electrical connection
- 6 = Air supply

SAFETY AND PRECAUTIONARY MEASURES

Be sure to observe safety and precautionary measures so as to avoid risk to persons and to prevent damage to the engine, trigger boxes, control units or the ignition system.

CAUTION!

High-energy ignition system with dangerous high and low voltages!

Touching live parts or terminals may be highly dangerous (both on the primary and secondary sides).

For compression test, detach main relay in order to prevent undesirable injection by injection valves and high-voltage flashovers.

Do not short-circuit ignition coil term.1 to ground (e.g. for stopping the engine). Ignition coil and possibly control unit shall be destroyed.

Never connect positive terminal of battery to ignition coil term.1. Control unit shall be destroyed.

When fitting an alarm system, following directions of installation instructions for Motronic vehicles or SIS microcard PKW 012. Ensure that the alarm relay is not disturbed by external fields (e.g. ignition cables) and therefore responds incorrectly.

SAFETY AND PRECAUTIONARY MEASURES (CONTINUED)

Never start engine without battery securely connected (battery terminals tightened). Do not disconnect battery from vehicle electrical system with engine running.

Do not use a fast charger for starting the engine.

Provide starting assistance only with second 12 V battery and jump leads.

Caution! Owing to non-standardized requirements of vehicle manufacturers with regard to electronic products, we advise against using a 24 V battery for starting assistance.

When charging the battery in the vehicle or providing starting assistance, follow the operating instructions for the fast charger as well as instructions of the vehicle manufacturer.

Disconnect battery from vehicle electrical system before charging or fast-charging.

Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery or ignition coil, may lead to the destruction of a control unit.

Do not connect or disconnect wiring-harness plugs from control units or trigger boxes with the ignition on.

Remove control units at temperatures above + 80° C (paint-drying installation).

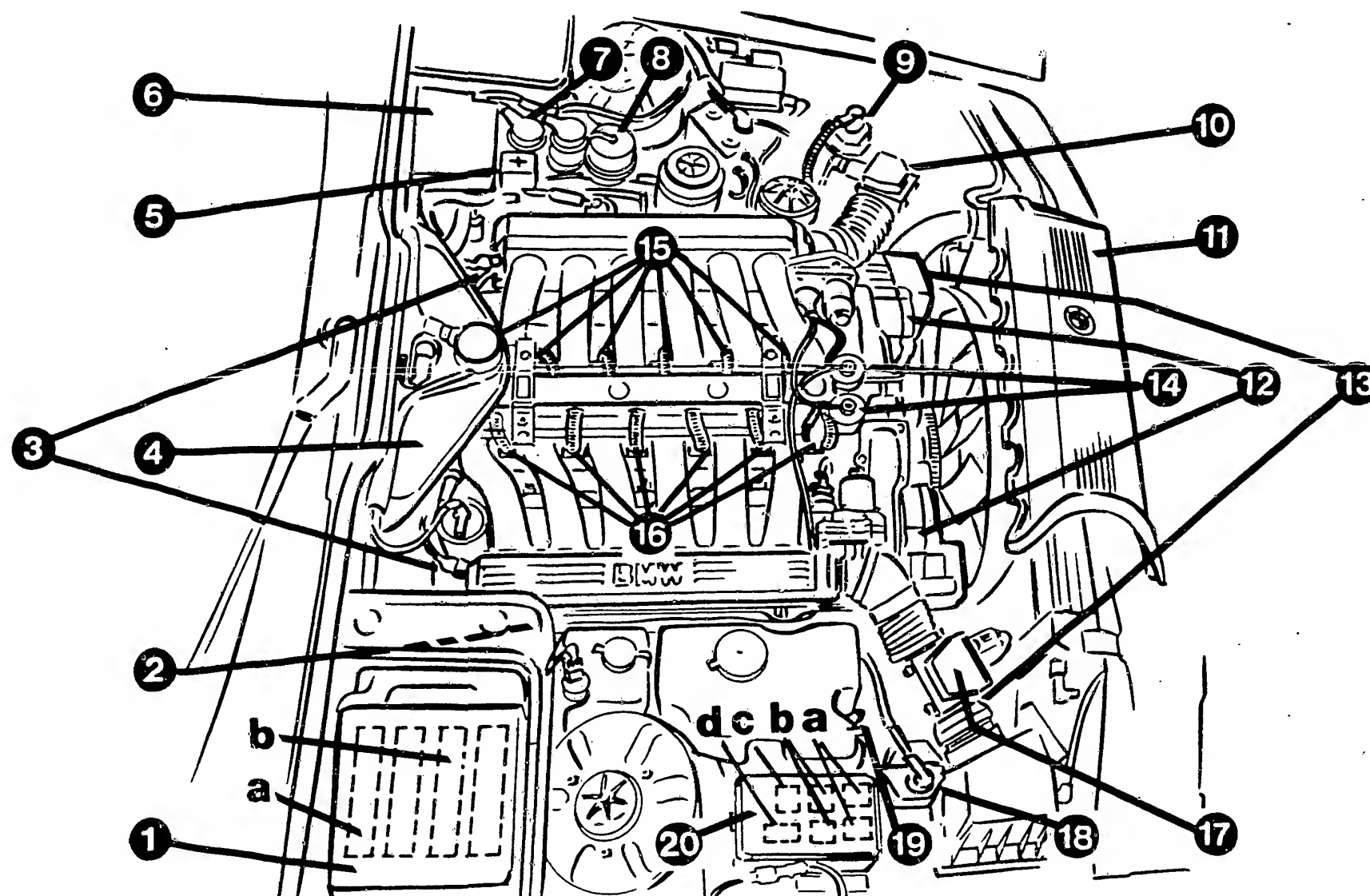
Remove control units before carrying out electric welding work.

TESTERS AND TOOLS

Name	Designation	Part No.
Engine tester	e.g. MOT 201	0 684 000 201
	MOT 300	0 684 000 300
	MOT 400	0 684 000 400
Exhaust analyzer	e.g. ETT 008.02	0 684 100 802
	ETT 008.03	0 684 100 803
Multimeter (Internal resistance at least 20 k Ω /V)	e.g. Digital Multimeter MMD 301	0 684 500 301
Pressure gauge 6 bar	Quality class 1.0 Scale division 0.1 bar	1 687 231 154
or Pressure measuring device		KDJE-P 100
or Pressure measuring device (no longer available)		KDEP 1034
Three-way line as connector for KDJE-P 100 and KDEP 1034		KDJE-P 100/13
Set of test cables		1 687 011 208
BMW diagnosis cable		1 684 463 196
Spark plug wrench with external guide	Source: 1. CARTOOL Hans Schubert Alfred Brehmstr.5 D-8070 Ingolstadt Part No. 12 11 71 or 2. Regional BMW Representative Part No. 12 11 71 or 3. Hazet (via trade) Part No. 880 A M g T -1	

TEST EQUIPMENT AND TOOLS (continued)

Description	Part no.
Feeler gauge for measuring sensor air gaps (up to 1 mm)	Commercially available
Lubricant for engine-speed and reference-mark sensor	Molykote Longterm 2, commercially available
Chassis dynamometer e.g. LPS 96 or LPS 002	0 680 017 001 0 680 100 200
Test lead 2-pole, for measuring resistances and signals e.g. at injection valves	1 684 463 093
Test leads for correct connection of testers at component plugs	KDZS 0004 (2.8 mm wide) KDZS 0005 (6.3 mm wide)
Mounting paste VS 14016 Ft for Lambda sensor and exhaust-gas screw plug	5 960 080 105
Hose clamber for pinching off fuel and air hoses	Commercially available



261 / 897

INSTALLATION POSITION OF COMPONENTS

1 = Control-unit box with:
 a = Motronic 1 control unit
 (right-hand cylinder bank)
 b = Motronic 2 control unit
 (left-hand cylinder bank)
 2 = Motronic ground terminals
 3 = Air temperature sensor (2)
 4 = Engine temperature sensor
 (2 sensors or twin sensor)
 5 = Battery positive terminal
 6 = Fuse box
 7 = Engine plug

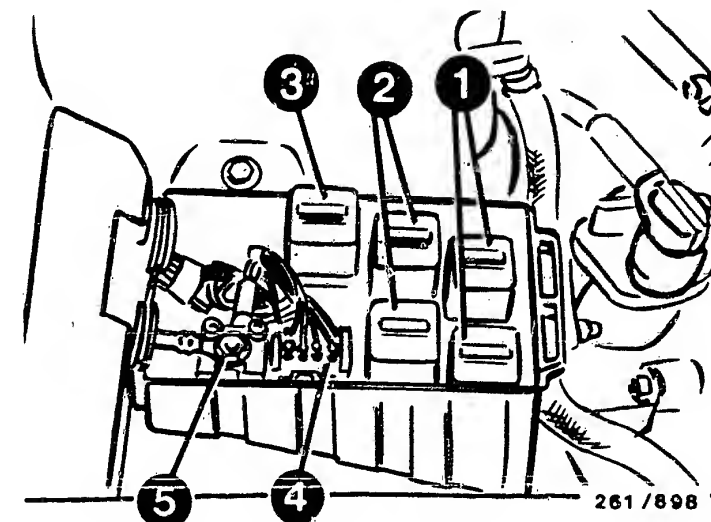
8 = Diagnosis unit
 9 = Ignition coil 2
 10 = Hot-wire air-mass meter 1
 11 = Cover over injection
 valves (removed)
 12 = H.T. distributor (2)
 13 = Tank ventilation valves
 (at air filter housings)
 14 = Pressure regulator (2)
 15 = Injection valves cyl. 7...12
 16 = Injection valves cyl. 1...6
 17 = Hot-wire air-mass meter 2

18 = Ignition coil 1
 19 = Active-carbon filter
 20 = Relay box with:
 a = Main relay (2)
 b = Fuel pump relay (2)
 c = Sensor heater relay
 d = 8-pole plug connection
 to transmission control

Note: Items a) and b) can
 be interchanged.

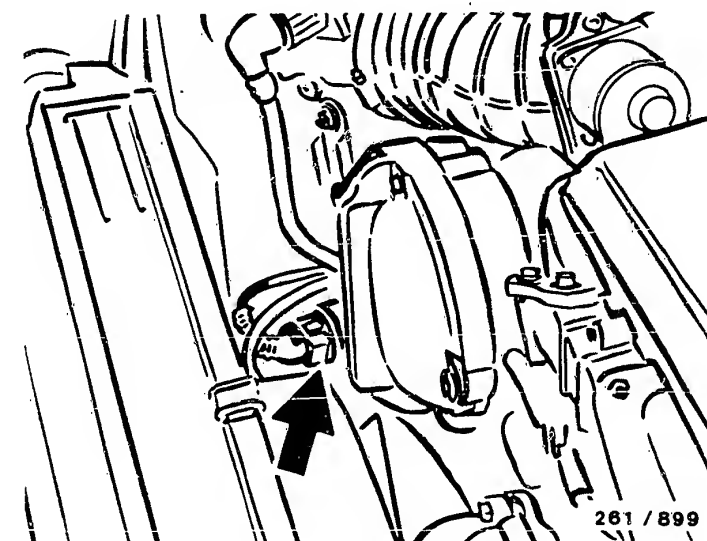
INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * Main and pump relay (2 each):
In relay box at right-hand spring-strut dome (top picture).
- * Sensor-heater relay:
In relay box at right-hand spring-strut dome (top picture).
- * Interface to transmission control (8-pole):
In relay box at right-hand spring-strut dome (top picture).
- * Control unit for electronic transmission control:
In A-pillar, right.
- * Additional positive terminal:
In relay box at right-hand spring-strut dome (top picture).
- * Lambda sensors (2):
Screwed in from above into catalytic converter for respective cylinder bank.
- * CO sampling points ahead of catalytic converter:
Two sampling points per cylinder bank in the exhaust manifolds of cylinders 1+2+3 /
/ 4+5+6 / 7+8+9 / 10+11+12.
- * Tank ventilation valves (2):
Secured to air-filter housings in engine compartment (see bottom picture, arrow for plug for tank ventilation valve of right-hand cylinder bank).



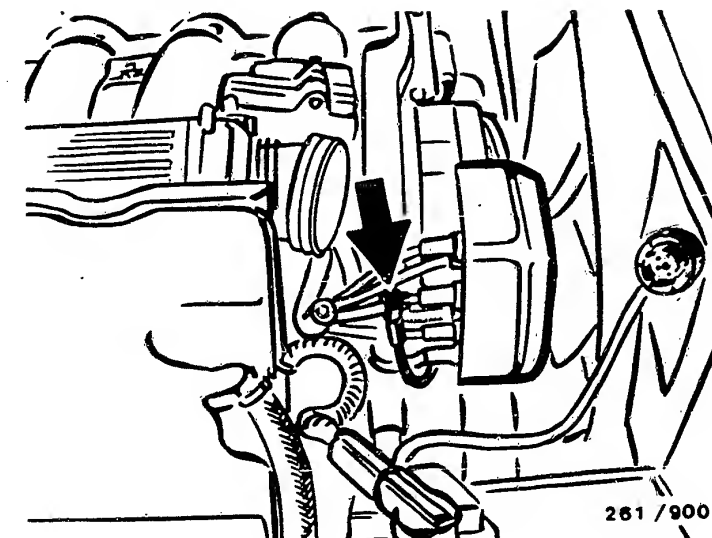
- 1 = Two main relays (5-pole)
- 2 = Two pump relays
- 3 = Sensor-heater relay
- 4 = Interface to transmission control (8-pole)
- 5 = Additional positive terminal

Note: Items 1 and 2 may be interchanged.

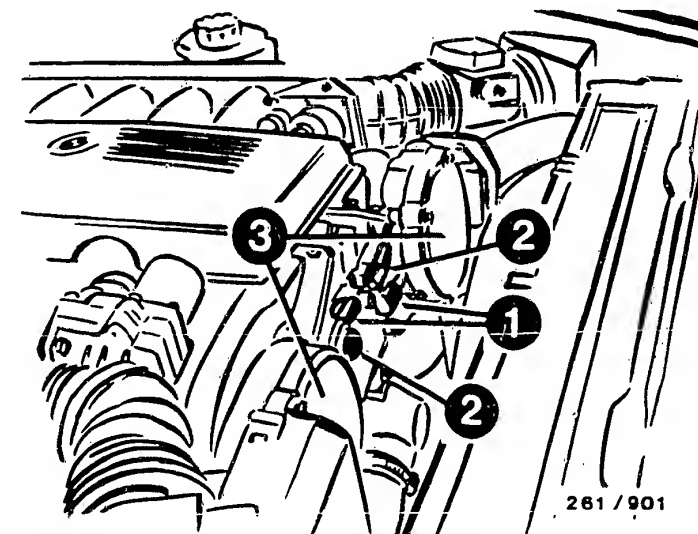


INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- * High-tension sensor (2):
On high-tension ignition cables of cylinders 6 and 12 (sensor of cyl. 6 in top picture, arrow).
Refer to brief instructions for test specification.
- * Plug connections for engine-speed/reference-mark sensor (2) and high-tension sensor (2):
At engine timing housing, front between high-tension distributors (bottom picture).
- * Electric fuel pumps (2):
In fuel tank (both pumps are mounted on a joint filter).
Note:
Access via cover in trunk.
- * Fuel filter (2):
Beneath vehicle, ahead of fuel tank.
- * Fuses for both electric fuel pumps:
In fuse box (No. 23 for right-hand, No. 24 for left-hand cylinder bank).
- * Battery:
Beneath rear-seat bench.



- 1 = Plug connections for engine-speed sensor
- 2 = Plug connections for high-tension sensor
- 3 = High-tension distributor



HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts with Coordinate B03 and contains customer complaint (fault symptom/fault characteristic feature) together with several possible causes in each case (component faults) and coordinate information for detailed trouble-shooting. If no coordinates are given, this is because the causes concerned do not require any test instructions.

In the event of a clearly established customer complaint, proceed consecutively and step by step as indicated in the trouble-shooting instructions in the stated sequence of possible causes.

Trouble-shooting should always be commenced with self-diagnosis (if provided) or with the universal test adapter (if envisaged). Only then should trouble-shooting be continued in line with the trouble-shooting chart.

In the event of a customer complaint which is not clear-cut, all causes indicated in the trouble-shooting chart must be tested. In order to avoid incorrect measurements, all causes are to be checked in the specified sequence (on account of interlinkage of test steps).

If the cause of the customer complaint has still not been eliminated after testing all possible faults, fit new prescribed ignition coil and/or trigger box/control unit.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

The TROUBLE-SHOOTING PROGRAM contains all system and component tests indicated in the trouble-shooting chart. It is sub-divided into three rows of boxes.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and fault elimination.

The right-hand column contains pictures/connection diagrams linked to the text together with explanatory notes.

If the questions posed in the left-hand column can definitely be answered with "yes", trouble-shooting is to be continued with the next box below.

If the answer to the question is "no", the center column must be applied and the tests performed in the sequence indicated there.

Following fault elimination, repeat test as a check.

TEST PREREQUISITES:

- Battery fully charged
- Engine in proper mechanical working order (e.g. compression, valve clearance etc.)
- Engine at operating temperature of approx. +80°C (if necessary)
- Proper connection of all connectors of wiring harness

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (Engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)	Coord.
*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis	B05
*											Voltage at control unit(s)	B19
*											Engine-speed/reference-mark sensor	D15
*	*			*	*						Fuel pressure	D25
*	*			*	*	*					Solenoid-op. inj. valve(s)	E13
	*	*									Idle switch (via electronic acc. pedal)	E17
				*							Full-load switch (via electronic acc. pedal)	E19
	*	*	*	*	*	*					Air-mass meter	C01F19
*	*	*	*								Air intake system	E25
		*									Idle speed, CO	F21
*		*		*	*						Ignition coil(s)	F11
*		*	*	*	*						Primary signal	F13
		*	*	*	*	*					Secondary pattern	F15
*	*	*	*		*	*		*	*		Ignition angle	F17
*			*								High-tension sensor	A17
		*									Overrun cutoff	F09
		*	*	*							Interference-supp. resis.	F15
			*	*							Interference	E15

B03

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (Engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (Ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)	Coord.
				*				*			Fuel delivery	E11
	*	*				*					Tank ventilation	F01
	*	*		*							Lambda closed-loop control	C11
*	*	*	*	*	*	*		*	*	*	Motronic control unit(s)	—
		*									Brake-safety and accelerator-pedal switch	F05
	*	*		*							Test electronic acc. pedal	—
			*								Test ETC	—

B04

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM

This vehicle features two Motronic control units with self-diagnosis. Trouble-shooting must therefore be commenced with self-diagnosis.

1. POCKET SYSTEM TESTER K T S 3 0 0 :

The fault memory of the self-diagnosis can be read out by means of the pocket system tester KTS 300 (0 684 400 300) with program module PPG 204 as of 09.01.1989 status. Pay attention to operating instructions for KTS 300. Connect KTS 300 via adapter lead 1 684 463 196 (BMW) to diagnosis socket in vehicle.

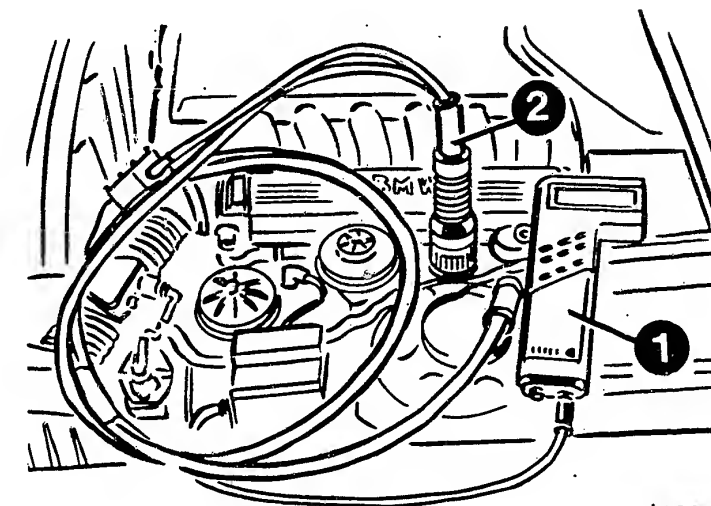
Note:

Further diagnosis possibilities (actuator diagnosis etc.), which would be feasible with newer program module statuses, are not evaluated on these vehicles.

2. FLASHING CODE :

As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units) (Motronic, right: flashing code 1xxx
Motronic, left: flashing code 2xxx).

Activation of the flashing-code self-diagnosis is described as of Coordinate B13.



261 / 902

- 1 = Pocket system tester KTS 300
- 2 = Adapter lead 1 684 463 196 (BMW)

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS
TEST TABLE AND TROUBLE-SHOOTING PROGRAM
(CONTINUED)

The self-diagnosis test table starting as of Coordinate B14 takes account of both the KTS 300 and the flashing code and is arranged according to fault-code numbers indicated by the KTS 300.

The "fault indication" column sometimes includes two types of fault optionally indicated by the tester, e.g.:

Open circ./short to ground (= 1st type of fault)
Short to positive (= 2nd type of fault)

The self-diagnosis test table contains the following:

- Fault indication in pocket system tester with fault code i.e. tested components or system functions
- Corresponding flashing-code output if no tester available (self-diagnosis by way of flashing code not possible with all control units)
- Test instructions/test conditions
- Terminals
- Set values
- Coordinate indication for trouble-shooting and fault elimination in subsequent self-diagnosis trouble-shooting program

The self-diagnosis test table, the self-diagnosis trouble-shooting program and the trouble-shooting program itself apply to both Motronic systems, so as to minimize the number of test steps.

USING THE SELF-DIAGNOSIS, SELF-DIAGNOSIS
TEST TABLE AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM
(Continued)

The self-diagnosis trouble-shooting program is divided into three columns starting at Coordinate B19.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and on how to rectify the fault.

The right-hand column contains the illustrations/terminal diagrams belonging to the text, together with explanations.

If the questions in the left-hand column can be answered conclusively with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there.

After rectifying a fault, repeat the test as a check.

If the self-diagnosis indicates a fault, but no system fault or component fault was found during trouble-shooting, try replacing the control unit.

If no more fault is indicated in self-diagnosis and the customer complaint has still not been eliminated (symptom of trouble), continue trouble-shooting with the trouble-shooting chart starting at Coordinate B03.

SELF-DIAGNOSIS

The following applies to models w i t h built-in fault lamp (CARB lamp) in instrument panel (currently only US version; "Check Engine"):

The fault lamp must light up once the ignition has been switched on. If there is no fault in the fault memory, then it goes out after the engine starts. If, on the other hand, there is a severe fault present (a so-called exhaust-relevant fault; static or sporadic fault), the fault lamp lights up continuously after starting the engine or lights up when the engine is running. The flashing-code fault output is effected by way of the fault lamp.

The following malfunctions can occur

1. CARB lamp flashes after switching on ignition.

- *Open circuit in one of the two actuation leads (Motronic term.15 up to lamp) or short circuit to positive (e.g. worn insulation with live lead).
- *One of the two Motronic control units is defective.
Refer to brief instructions ("Electrical terminal diagram").

2. Fault lamp does not light up after switching on ignition.

- *Check fault lamp.
- *Fault lamp has no positive voltage supply
- *Open circuit in both actuation leads or Motronic control unit defective.

For production reasons:
continued on the following
coordinate.

SELF-DIAGNOSIS (CONTINUED)

A lamp must be connected to term.15 of the control unit for reading out the fault memory in the case of models with no built-in fault lamp in the instrument panel or if there is no KTS 300. For this purpose, the evaluation unit for flashing-code diagnosis KDAW 9980 is to be connected to the control-unit plug, making sure that the control-unit plug is not detached from the control unit as otherwise the stored faults would be cleared. Only loosen handle cover, do not lift plug insert.

Opening control-unit plug (top picture)

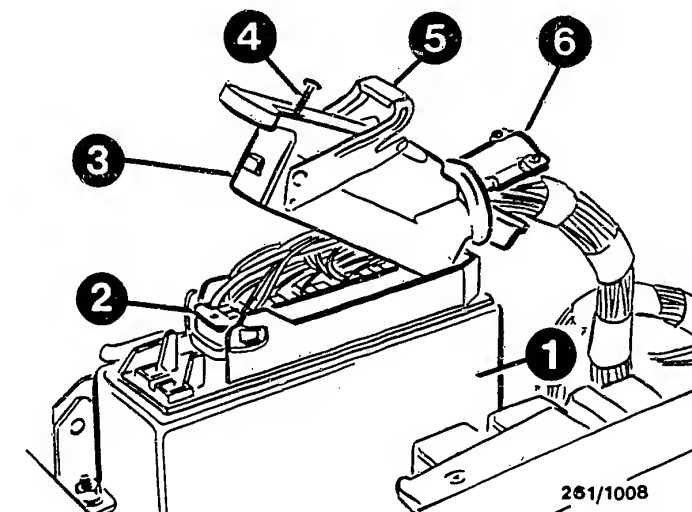
Switch off ignition

Loosen screws of strain relief and screw at unlocking lever. Hold down plug insert by inserting suitable wire through hole in unlocking-lever screw.

Open up locking lever. Swivel up plug housing until it can be disengaged from mechanical encoder.

Push back plug housing over wiring harness.

Perform work carefully to ensure that plug insert does not lift off control unit.



- 1 = Motronic control unit
- 2 = Plug insert
- 3 = Handle cover (Plug housing)
- 4 = Screw on unlocking lever
- 5 = Unlocking lever
- 6 = Strain relief

Connection of fault lamp (KDAW 9980; bottom picture)

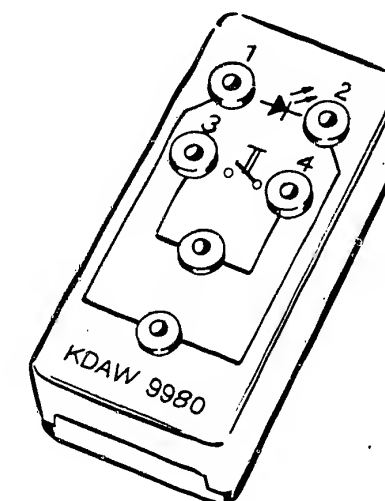
The evaluation unit for flashing-code diagnosis is connected up as follows:

Socket 1 (red) to battery positive (term.30).

Socket 2 (black) to respective Motronic control unit term.15 (Term.15 of control unit may be wired up despite the fact that there is no CARB lamp; use suitable test prod).

Sockets 3 and 4 are not connected.

Evaluating unit KDAW 9980



SELF-DIAGNOSIS (CONTINUED)

Activation of self-diagnosis (flashing-code output)

Note: Activation of the flashing-code output is not possible if the pedal-position sensor or EMS control unit is defective (no full-load output to Motronic).

1. Switch on ignition. Do not allow the engine to run!
Wait for 2.5 seconds prior to stimulation process.
2. Effect stimulation:
Accelerate to full throttle 5 times within 5 seconds in the case of Motronic, left.
Accelerate to full throttle 6 times within 5 seconds in the case of Motronic, left
3. The fault lamp then lights up for approx. 2.5 seconds (start pulse).
4. The start pulse is followed by the actual fault output:
in the case of Motronic, right the flashing codes start with 1 x x x,
in the case of Motronic, left the flashing codes start with 2 x x x.

Evaluation of flashing fault code

The flashing code for each fault consists of four flashing-pulse blocks. Each block represents a number and contains between 1 and 9 pulses. One pulse corresponds to number 1, 9 pulses to number 9. The fault lamp lights up briefly with each pulse. The pause between the blocks is longer than that between the individual pulses.

The respective flashing-code word e.g. 1215 is constantly repeated. A pulse duration of approx. 2.5 seconds between the flashing-code words is designed to act as delimitation.

Renewed stimulation causes the next fault to be output.
A maximum of 5 faults can be stored.

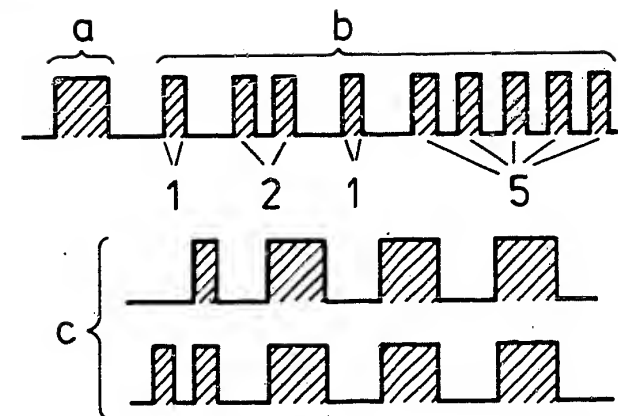
Possible flashing-code outputs following multiple stimulation

1st stimulation process:

Fault output or no fault stored (flashing code 1444 or 2444).

2nd stimulation process:

Next fault is output or, if there is no further fault stored, flashing code "end of output" appears (1000 or 2000 with the 0 being indicated by rhythmic lighting up of the fault lamp with pulses of approx. 2.5 s duration).



261/903

a = Start pulse
b = Fault code 1 2 1 5
c = Flashing code 1000 / 2000
(end of output,
right/left)

Cross-hatched pulse area =
fault lamp lights up

SELF-DIAGNOSIS (CONTINUED)

3rd stimulation process:

If all faults have been output (max. 5 faults) and if "end of output" appeared as the last flashing code, then the fault lamp goes out or it reverts after a further stimulation process to being continuously lit.

4th stimulation process:

Clearing of fault memory possible. Clearing can be effected during the flashing code "end of output" by accelerating to full throttle for at least 10 seconds. The faults stored in the control unit are thus cleared.

5th stimulation process:

If a further stimulation process is executed when the fault lamp has gone out or the lamp is continuously lit (see 3rd stimulation process), then the fault output starts again from the beginning. If the faults have been cleared, the flashing code 1444 or 2444 appears.

Clearing fault memory

1. With system tester KTS 300 (clear command)

2. During the flashing code "end of output" by means of stimulation (accelerator pedal fully depressed) for a minimum of 10 seconds.

Or:

Detach battery or control unit for at least 10 seconds.

Or:

Switch ignition off and on again at least 5 times.

Self-diagnosis is terminated after switching off the ignition.

SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Coord- inates
Data exchange not possible	—	—	B19
Control unit Digital sec.(comput) defective	01	1211 2211	B21
Relay Fuel pump Op.circ/sh.to grnd. Short to B+	03	1261 2261	B23
Valve Tank ventilation Op.circ/sh.to grnd. Short to B+	05	1263 2263	B25
Air-flow sensor/ Air-mass sensor Signal too low Signal too high	07	1215 2215	C01
Lambda control outside min. range outside max. range	10	1222 2222	C11
Fault lamp Op.circ/sh.to grnd. Short to B+	15	—	B09

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flash- ing code	Coord- inates
Injectors (Group 2) Op.circ/sh.to grnd. Short to B+	16	1251 2251	C13
Injectors (Group 1) Op.circ/sh.to grnd. Short to B+	17	1252 2252	C15
Relay Sensor heater Op.circ/sh.to grnd. Short to B+	23	1264 2264	A04
Lambda sensor Open circuit Short to ground Short to B+	28	1221 2221	C17
Battery voltage too low too high	37	1231 2231	C21
ASR/MSR interface Short to B+	38	— —	C25

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Pocket system tester Fault indication	Fault code	Flash- ing code	Coord- inates
Air-temp. sensor Op.circ./sh.to B+ Short to ground	44	1224 2224	C27
Engine temp. sensor Op.circ./sh. to B+ Short to ground	45	1223 2223	D03
Transmission identification Short to ground	51	1278 2278	D07
Idle switch Short to ground	52	1232 2232	D09
Full-load switch Short to ground	53	1233 2233	D11
Converter clutch/ Driving pos. switch Comparison not O.K.	54 (24)	— —	D13
CU output stages with fin.cntling el. defective	100	— —	—
No fault stored	—	1444 2444	—

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (1)

TESTER FAULT CODE: —
 "Data exchange not possible"
 (FLASHING CODE: — / —)

Prerequisites for data exchange,
 control unit/tester or
 flashing-code output:

1. Voltage supply of Motronic control unit(s) O.K.
2. Following connections must be in order:
 Control unit term.13 to diagnosis connection 15 (stimulation lead);
 control unit term. 55 to diagnosis connection 20 (serial interface) and
 control unit term. 15 (actuation lead of fault lamp) to fault lamp.
2. Positive supply of fault lamp (+12V) present.
3. Control unit(s) O.K.
4. Applies only to 750i:
 Control unit term. 40 of Motronic 2 connected to ground (term. 40 of Motronic 1 open) so that the diagnosis can distinguish between the two control-units (right/left).

Data exchange/flashing-code
 output possible ?

N>

*Measure supply voltage of control units:
 Battery voltage must always be present at control-unit plug term.18 (continuous positive) and at term.27 and term.37 with respect to term.19 (ground) with ignition switched on.

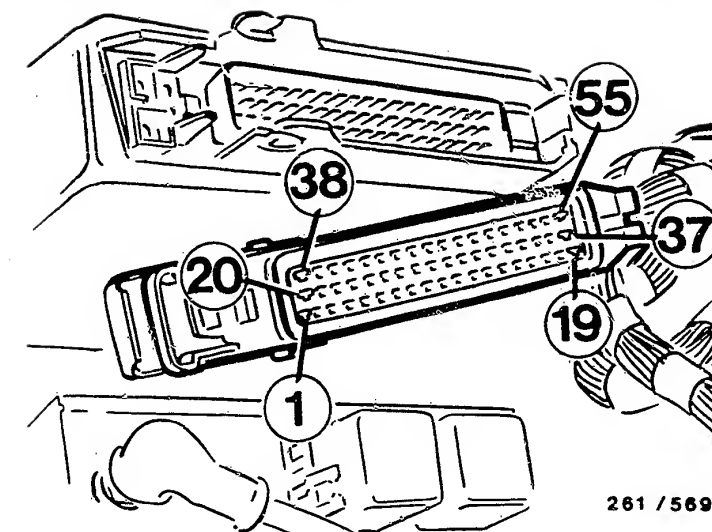
If there is no voltage present:

1. Check corresponding leads in accordance with terminal diagram for continuity (including connection between control units term.36 and main relay term.85).
2. Test main relay.

*It must not be possible to push back the spring contacts in the control-unit plugs or the connections in the diagnosis unit.

*Tester properly connected?

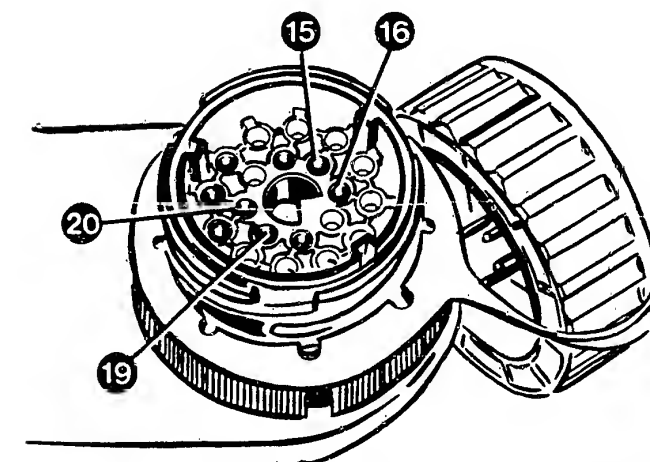
If no faults were established, the control unit(s) is/are to be renewed.



261 / 569

Top view of 55-pin control-unit plug for Motronic wiring harness

Diagnosis unit



141 / 310

Return to self-diagnosis
 test table B16

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (2)

TESTER FAULT CODE: 01
(FLASHING CODE: 1211 / 2211+)

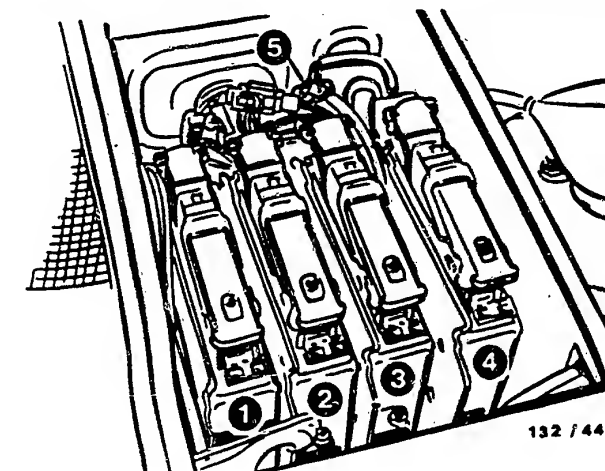
Self-test of digital section
(program memory) in
control unit.

Tester code or flashing
code not present?

+) Second flashing code
applies to Motronic, left.

N>

Replace control unit

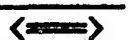


132 / 44

- 1 = Motronic control unit of
right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of
left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit

Return to self-diagnosis
test table B16

B21



B22



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (3)

TESTER FAULT CODE: 03
(FLASHING CODE: 1261 / 2261)

Fault in current path, fuel pump relay.

Trouble-shooting procedure:

- *Detach fuel pump relay and measure resistance of relay coil (term. 86 with respect to term. 85 on relay).
SET VALUE: approx. 50...150 Ω
- *Measure voltage at term. 86 at relay frame with respect to vehicle ground with ignition switched on.
SET VALUE: battery voltage
- *Ignition off, detach control unit:
Check actuation lead of fuel pump relay (term. 85 in relay frame to term. 3 in control-unit plug) for continuity (approx. 0 Ω). It must not be possible to push back spring contacts in control-unit plug.
- *Check same lead for short to ground and short to positive (approx. infinity Ω between term. 85 and all other connections in relay frame as well as vehicle ground).
Note: Pay attention to worn insulation!

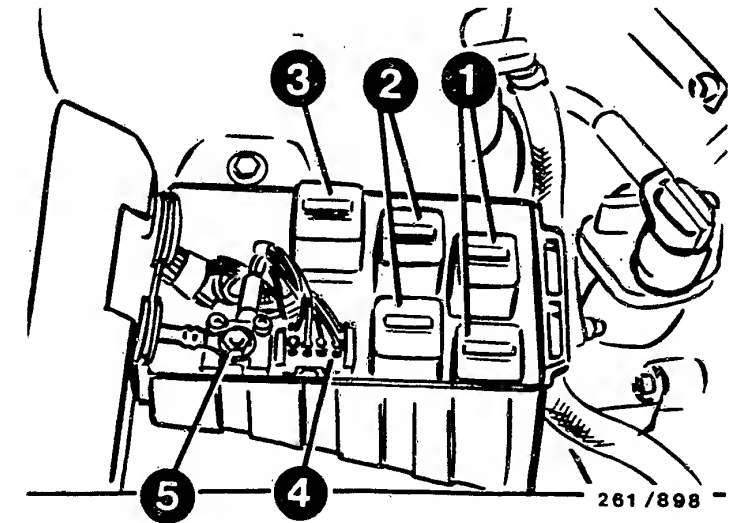
All tests O.K.?

N>

*Renew fuel pump relay if resistance of relay coil is not within tolerance.

*If no voltage at term. 86 with ignition switched on, test for continuity in lead to main relay term. 87.

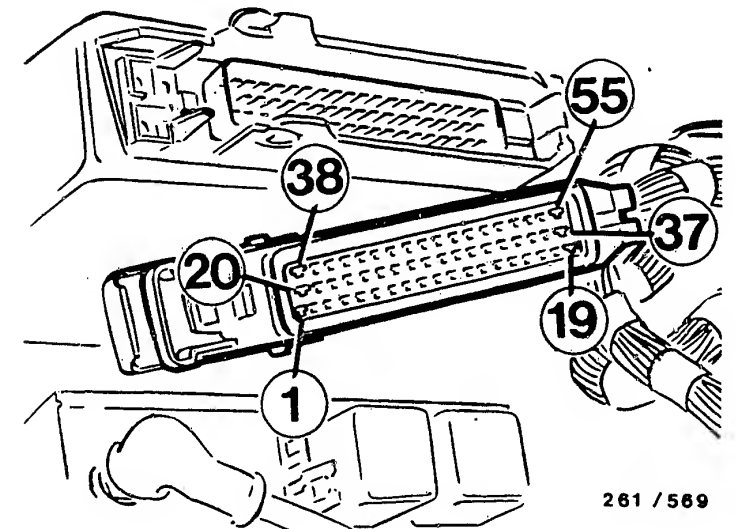
*If actuation lead of fuel pump relay and spring contacts in control-unit plug O.K., it must be assumed that output stage is defective.
Renew control unit.



- 1 = Two main relays (5-pole)
- 2 = Two pump relays
- 3 = Sensor-heater relay
- 4 = Interface to transmission control (8-pole)
- 5 = Additional positive terminal

Note: Items 1 and 2 may be interchanged.

Top view of 55-pin control-unit plug for Motronic wiring harness



Return to self-diagnosis test table B16

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (4)

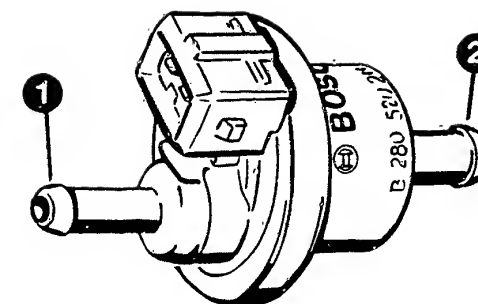
TESTER FAULT CODE: 05
(FLASHING CODE: 1263 / 2263)

Test tank ventilation
valve (top picture):
Detach plug from tank ventilation
valve.
Check resistance directly at
plug pins of tank ventilation
valve.

Set value:
see brief instructions

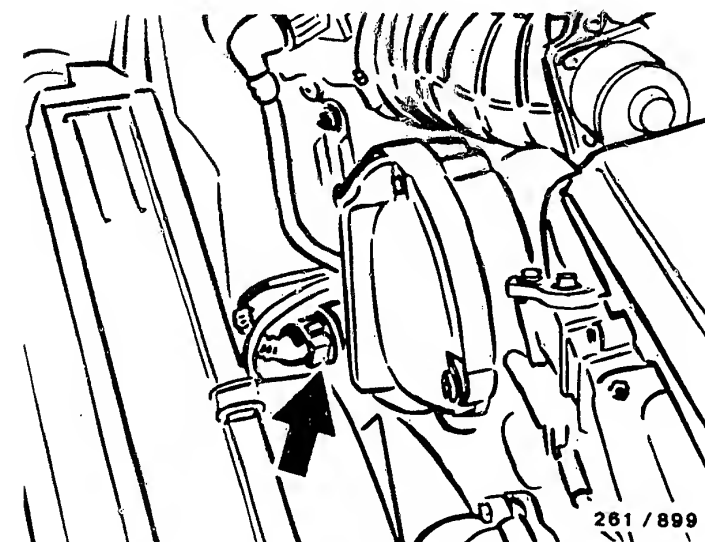
Is set value attained?

Replace tank bleeder
valve.



261 / 592

Arrow = Plug to tank ventilation
valve of right-hand
cylinder bank



261 / 899

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (4) CONTINUED (1)

↓
Visually inspect plug of tank
ventilation valve:

N>

Plug properly attached,
contacts corroded? Spring
contacts must be engaged and
it must not be possible to
push them back.

Check leads from tank
ventilation valve to
control-unit plug term.5(-) and
to main relay term.87(+) with
ohmmeter for open
circuit and short to
ground as well as short
circuit. Pay attention
to worn insulation.

Is plug O.K.?
Leads O.K.?

*Eliminate defects at plugs;
renew spring contacts
if necessary.

*Eliminate contact resistances,
open circuits and short circuits
at leads.

↓
Return to self-diagnosis
test table B16

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (5)

TESTER FAULT CODE: 07
(FLASHING CODE: 1215 / 2215)

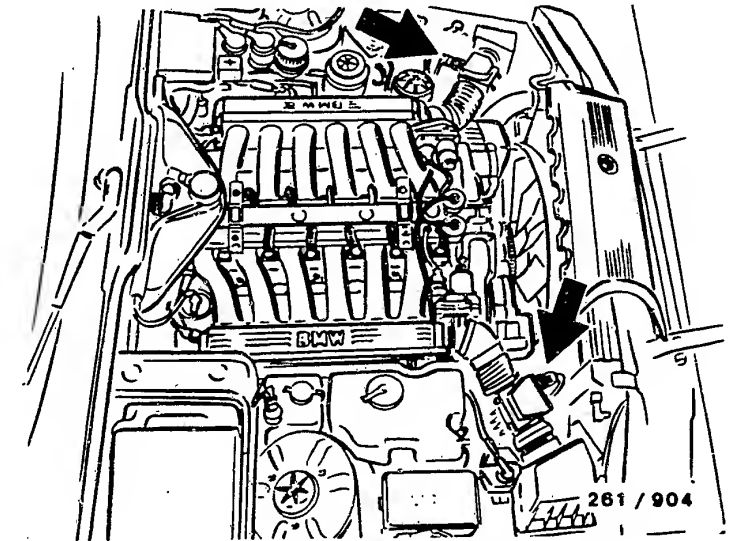
Test hot-wire air-mass
meter with ohmmeter

Detach plug of air-mass meter
(arrows in picture).
Measure resistances directly
at plug pins of air-mass
meter.

Set values between
term.5 and term.4
term.6 and term.4
See brief instructions.

Are set values attained?

N> Renew hot-wire air-mass meter.



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (5) CONTINUED (1)

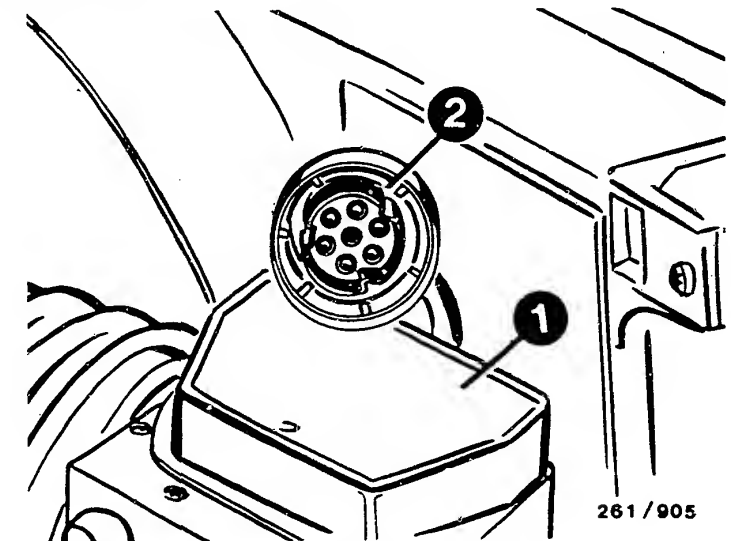
Visually inspect plug of
hot-wire air-mass meter:

N>

Eliminate defects on plug.
If necessary, replace plug
or spring contacts.

Plug properly attached, contacts
corroded? Spring contacts
must be engaged and it must
not be possible to push
them back.

Is plug O.K.?



1 = Hot-wire air-mass
meter (HLM)

2 = Plug of HLM

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (5) CONTINUED (2)

Connect voltmeter to air-mass-meter plug term.2(+) and term.4(-); switch on ignition.

Set value: approx. battery voltage.

Is set value attained?

N>

Check lead from air-mass meter term.2 to main relay term.87 and from term.4 to central ground for continuity.

Eliminate open circuits.

Renew corresponding main relay if there was no open circuit.

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (5) CONTINUED (3)



Check following leads for continuity, short to ground and short to positive:

From air-mass meter	To control unit
Term.5	Term.26
Term.6	Term. 7

Additionally check the two leads for mutual contact.

Tests O.K.?

N>

Eliminate open circuits and short circuits.



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (5) CONTINUED (4)

Connect air-mass meter.

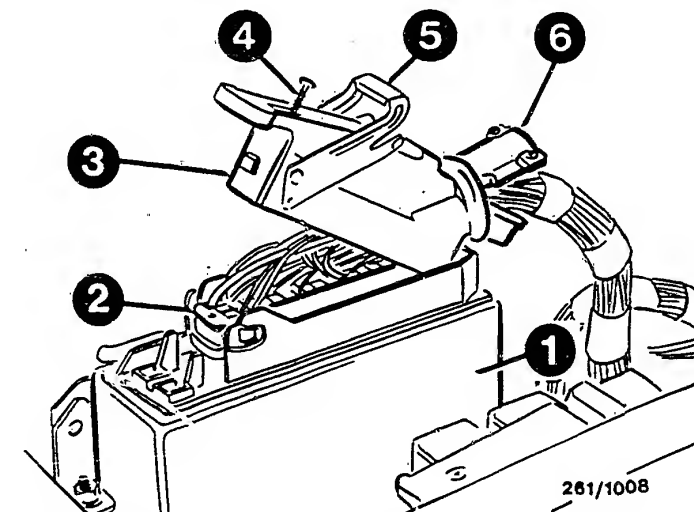
Ignition switched off.
Lift handle cover (plug housing)
off control unit, however
leave plug connected or
reconnect.

Connect analog voltmeter
with test prods to control-
unit plug term.7(+) and
term.26(-).

Start engine and allow it
to idle.
Briefly open throttle
(accelerate):
Voltage must increase for a
brief period and then drop
back again.

Are set values attained?

Renew hot-wire air-mass meter.



- 1 = Motronic control unit
- 2 = Plug insert
- 3 = Handle cover
(Plug housing)
- 4 = Screw on unlocking
lever
- 5 = Unlocking lever
- 6 = Strain relief

Return to self-diagnosis
test table B16

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (6)

TESTER FAULT CODE: 10
(FLASHING CODE: 1222 / 2222)

Lambda closed-loop control
on rich or lean stop.

Possible causes of trouble:

*Leak in air intake system
or exhaust system (particularly
upstream of Lambda sensor)

*Fuel pressure or delivery
outside tolerance

*Defective injection valves

*Extreme incorrect setting
of idle-mixture-adjusting screw

*Air-flow sensor/air-mass
meter defective

*Tank ventilation defective

*Fuel tank run empty

Stated items O.K.?

N>

Measure CO content ahead of
catalytic converter (engine and
catalytic converter at operating
temperature):

Set value: see brief instructions

* If mixture too lean:

-Test air intake system for leaks.
Eliminate leaks by using new seals
or by tightening tie bands.

-Deposits on injection valves

-Fuel pressure/delivery of electric
fuel pump too low.

See brief instructions for set
values.

-Extreme incorrect setting of
idle-mixture-adjusting screw.

-Test air-flow sensor/air-mass
meter.

* If mixture too rich:

-Fuel pressure too high

-Injection valves defective (leak)

-Extreme incorrect setting of idle-
mixture-adjusting screw.

-Tank ventilation valve defective.

-Test air-flow sensor/air-mass
meter.

-Leak in exhaust system.

N o t e :

In spite of a correct CO content
when idling, mixture deviations in
other engine operating statuses
can cause the lambda closed-loop
control to reach the stop.

Return to self-diagnosis
test table B16

C11

<==>

C12

<==>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (7)

TESTER FAULT CODE: 16
(FLASHING CODE: 1251 / 2251)

Injection valves cyl. 1,3,5
or cyl. 7,9,11 (group 2,
right or left).

*Check positive and ground
leads to term.16 for open
circuit, short to ground and
short to positive. Watch
out for worn insulation.
Check squashed multiple butt
connectors beneath cover for
proper contact.

*Check injection-valve and
control-unit plug for proper
contact and corrosion.
It must not be possible to
push back spring contacts.

*Measure winding resistances
of injection valves.

Set value:

see brief instructions

*Measure injection signal of
group 2 (measurement method,
including for individual
valves, is described in
trouble-shooting program).

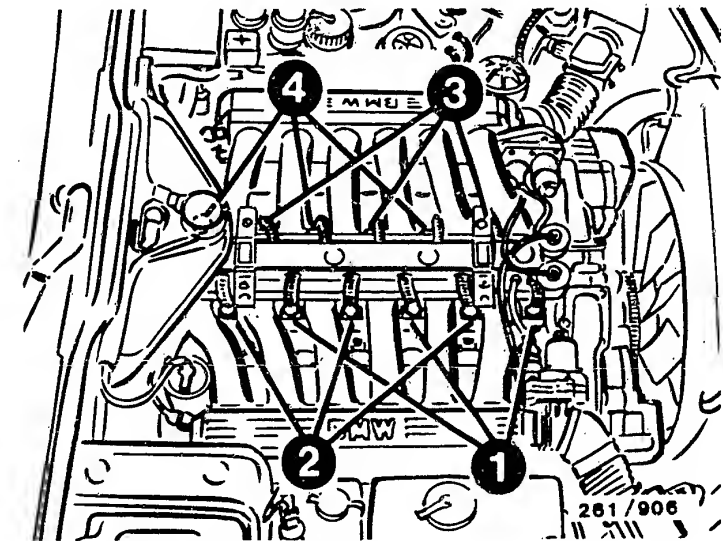
Leads, plug connections,
injection valves and signal
O.K.?

N>

-Rectify problems with
leads and plug-in
connections.

-Replace defective injection
valves.

-If peripherals are O.K. and
no injection signal is
visible, replace control
unit.



- 1 = Injection-valve plug
(Cylinders 1, 3, 5)
- 2 = Injection-valve plug
(Cylinders 2, 4, 6)
- 3 = Injection-valve plug
(Cylinders 7, 9, 11)
- 4 = Injection-valve plug
(Cylinders 8, 10, 12)

Return to self-diagnosis
test table B17

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (8)

TESTER FAULT CODE: 17
(FLASHING CODE: 1252 / 2252)

Injection valves cyl. 2,4,6
or cyl. 8,10,12 (group 1,
right or left).

*Check positive and ground
leads to term.17 for open
circuit, short to ground and
short to positive. Watch
out for worn insulation.

Check squashed multiple butt
connectors beneath cover for
proper contact.

*Check injection-valve and
control-unit plug for proper
contact and corrosion.
It must not be possible to
push back spring contacts.

*Measure winding resistance
of injection valves.

Set values:

see brief instructions

*Measure injection signal of
group 1 (measurement method,
including for individual valves,
is described in trouble-shooting
program).

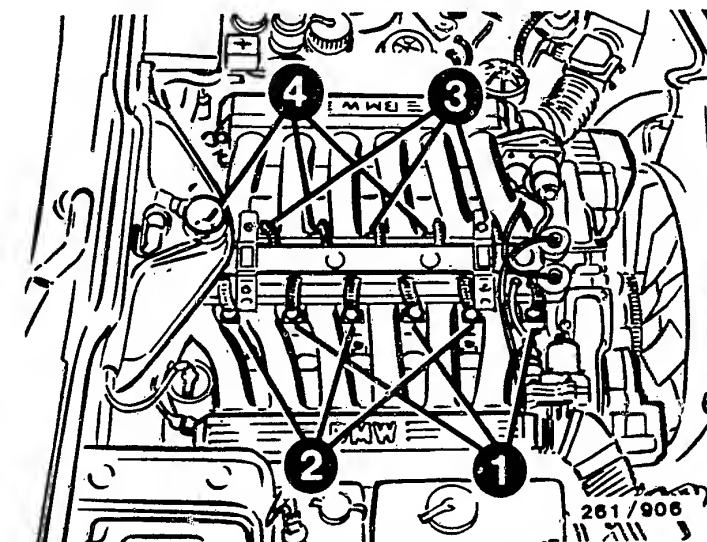
Leads, plug connections,
injection valves and signal
O.K.?

N>

-Rectify problems with
leads and plug-in
connections.

-Replace defective injection
valves.

-If peripherals are O.K. and
no injection signal is
visible, replace control
unit.



1 = Injection-valve plug
(Cylinders 1, 3, 5)

2 = Injection-valve plug
(Cylinders 2, 4, 6)

3 = Injection-valve plug
(Cylinders 7, 9, 11)

4 = Injection-valve plug
(Cylinders 8, 10, 12)

Return to self-diagnosis
test table B17

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (9)

↓

TESTER FAULT CODE: 28
(FLASHING CODE: 1221 / 2221)

Lambda-sensor function
defective.

*Check sensor leads with
ohmmeter for open circuit
Signal: control-unit term.28
to Lambda-sensor plug
connection 2
Signal ground: term.10 to
connection 1

*Check plug connection for
corrosion and loose
contacts.
It must not be possible to
push back contacts.
Check sensor heater
(connections 4 and 3).

*Check sensor signal lead
with ohmmeter for short
circuit (contact) to
ground or to live lead
(short circuit with
battery voltage due to
insulation damage).
Pay attention to worn
insulation (insulation
damage) and loose contact.

Leads and plug O.K.?

↓

↓

Continued on next picture page

N>

Repair defective lead/plug.

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (9) CONTINUED (1)

V

Replace Lambda sensor.

Clear fault memory,
perform test drive and
interrogate self-diagnosis
again.

Fault code no longer
present?

N>

Replace control unit

Y

Return to self-diagnosis
test table B17

C19

<==>

C20

<==>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10)

TESTER FAULT CODE: 37
(FLASHING CODE: 1231 / 2231)

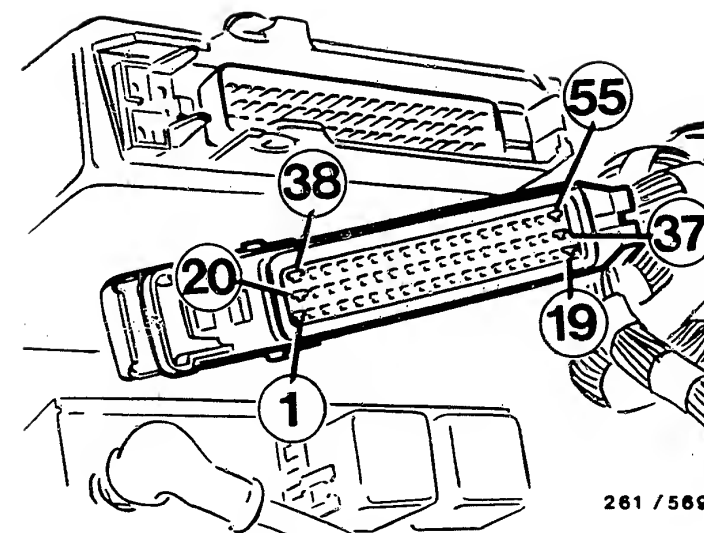
1. Supply voltage at control unit term.37 (+) and term.19 (-) less than 9 V with engine running:
 - * Check voltage dips (contact resistances) at ground terminal and positive lead.
 - * Terminals and plug connections must be bright and corrosion-free.
 - * Check positive terminals affected:
 - At main relay term.87 and term.30 as well as at battery terminal B+ and ignition lock term.15.
 - * Check main relay.
 - * Check battery charge.

2. Supply voltage at control unit term.37 (+) and term.19 (-) greater than 16 V with engine running:
 - * Check alternator regulator.

Voltage dips eliminated?
Main relay O.K.?
Battery adequately charged?
Alternator regulator O.K.?

N>

- 1). If voltage too low:
 - * Eliminate defects at terminals; renew plug connections if necessary.
 - * Replace main relay.
 - * Charge battery.
- 2). If voltage too high:
 - * Replace alternator regulator.



Top view of 55-pin control-unit plug for Motronic wiring harness

Return to self-diagnosis test table B17

TESTER FAULT CODE: 38
(FLASHING CODE: — / —)

Detach both Motronic control-unit plugs and the ABS/ETC/MSR control-unit plug with ignition switched off.

1. Check ETC interface:

Use ohmmeter to check lead between each Motronic plug term.38 and ABS/ETC/MSR plug term.45 for continuity (approx. 0 Ω).

2. Check MSR interface:

Use ohmmeter to check lead between each Motronic plug term.50 and ABS/ETC/MSR plug term.47 for continuity (approx. 0 Ω).

Note:

Spring contacts in control-unit plugs must be engaged and it must not be possible to push them back.

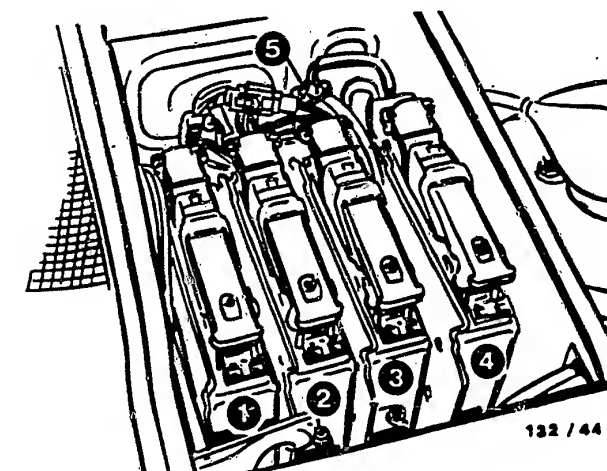
Spring contacts engaged?

Leads between control units O.K.?

N>

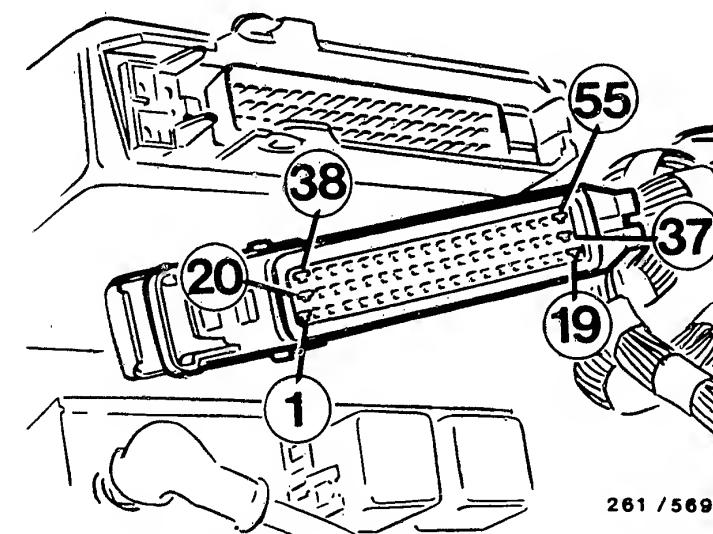
*Eliminate defects at plugs; renew spring contacts if necessary.

*Eliminate contact resistances, open circuits and short circuits at leads.



- 1 = Motronic control unit of right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit

Top view of 55-pin control-unit plug for Motronic wiring harness



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (11) CONTINUED (1)

Check ETC action:

Vehicle on dynamometer (rear axle).

Switch off engine.

Caution, secure test bench!

1. Switch on ignition:

ETC indicator lamp in "ASC" button on center console must light up; if not, further trouble-shooting in ETC.

Note: if ETC defective, Check Control indicates "ASC defective".

2. Start engine:

ETC indicator lamp continues to light up (ETC is switched off and on by actuating "ASC" button).

3. Engage driving position and accelerate cautiously:

ETC effects regulation if acceleration in excess of 20 km/h is not possible (ETC indicator lamp flashes and Check Control indicates "ASC"); if not, further trouble-shooting in ETC or EMS.

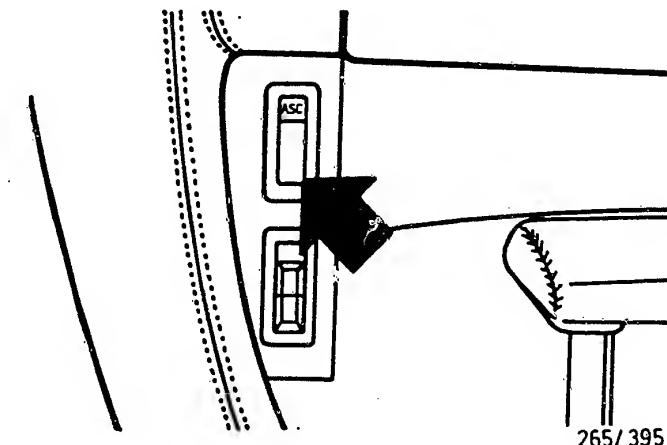
4. Brake vehicle, switch off ETC and switch ETC on again at a constant speed of approx. 50 km/h (do not alter position of accelerator pedal): engine hunts, vehicle loses speed.

Test O.K.?

N>

*Check ETC in accordance with SIS.

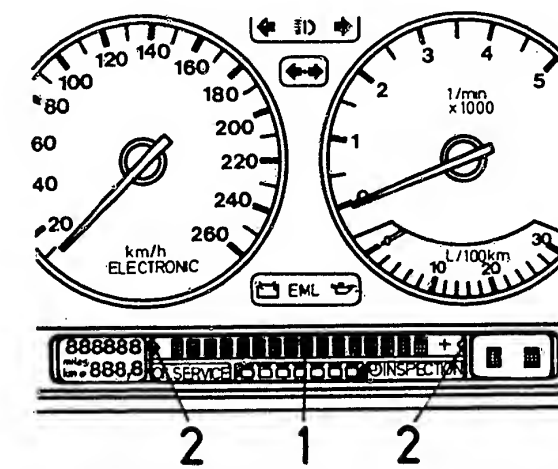
*Motronic control unit defective (ETC input, term.38).



265/395

Arrow = ASR repeater lamp and ASR nonlocking switch

1 = Check control indicator
2 = Indicator lamp



265/397

Return to self-diagnosis test table B17

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12)

TESTER FAULT CODE: 44
(FLASHING CODE: 1224 / 2224)

N>

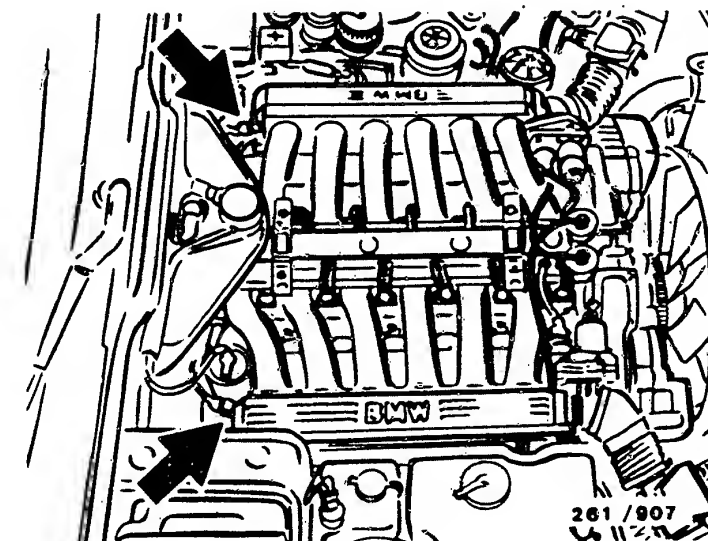
Renew temperature sensor.

Check temperature sensor (air)
in intake manifold:

Detach plug of temperature
sensor (arrows in picture).
Test resistance directly
at temperature sensor.

Set value:
see brief instructions

Is set value attained?



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12) CONTINUED (1)

Visually inspect plug of temperature sensor:

Plug properly connected, contacts corroded? Spring contacts must be engaged and it must not be possible to push them back.

Is plug O.K.?

Eliminate defects on plug.
If necessary, replace plug
or spring contacts.

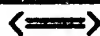
Using ohmmeter, check leads to temperature sensor for open circuit and short circuit.
From temperature-sensor plug to control-unit plug term. 44 and to vehicle ground.

Leads O.K.?

Eliminate contact resistances,
open circuits or short circuits
on leads.

Return to self-diagnosis
test table B17

D01



D02



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13)

TESTER FAULT CODE: 45
(FLASHING CODE: 1223 / 2223)

N>

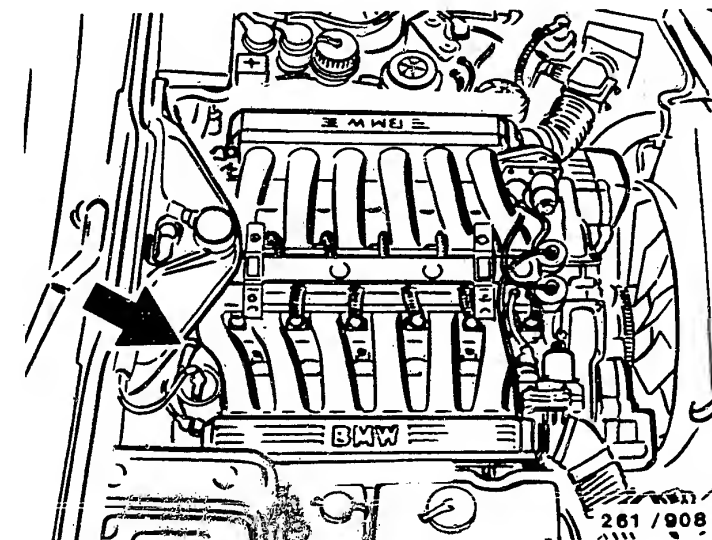
Renew temperature sensor.

Check temperature sensor
(engine):
Detach plug of temperature
sensor.

Check resistance directly
at temperature sensor
(if twin sensor, between
term.1 and term.2 as well
as term.3 and term.2).

Set value(s):
see brief instructions

Is set value attained?



Arrow =
Installation position of twin
engine-temperature sensor or
the two engine-temperature sensors
(depending on version)

Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED (1)

Visually inspect plug of temperature sensor:

Plug properly connected, contacts corroded? Spring contacts must be engaged and it must not be possible to push them back.

Is plug O.K.?

Eliminate defects on plug.
If necessary, replace plug
or spring contacts.

Using ohmmeter, check leads to temperature sensor for open circuit and short circuit. From temperature-sensor plug to control-unit plug term. 45 and to vehicle ground.

Leads O.K.?

Eliminate contact resistances, open circuits or short circuits on leads.

Return to self-diagnosis
test table B18

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (14)

TESTER FAULT CODE: 51
(FLASHING CODE: 1278 / 2278)

Transmission action via term.51
always active, i.e. term.51
permanently on ground.

Test:

With ignition switched on,
measure voltage at connection
1 of 8-pole plug connection
to transmission control unit.

Set value: greater than 3.5 V

Is voltage greater than 3.5 V ?

N>

Function of transmission intervention:

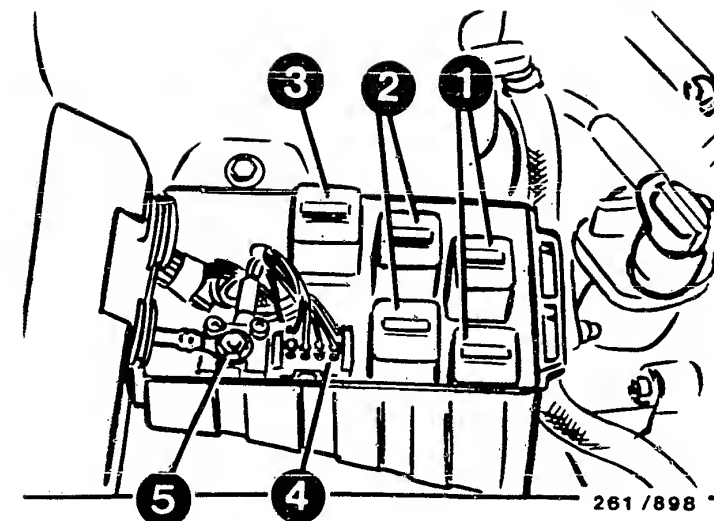
The Motronic is informed by the
transmission control of gear-shift
operations in that a pulse is
passed to the Motronic control unit
on changing gear (bottom picture).

Possible causes of trouble with fault code 51:

- *Lead from Motronic control unit
via 8-pole plug connection
(term.1) to control unit,
transmission control (GS)
shorted to ground
worn insulation?)
- *Control unit, transmission
control (GS) defective
(A-pillar, right)
- *Motronic control unit defective

Procedure:

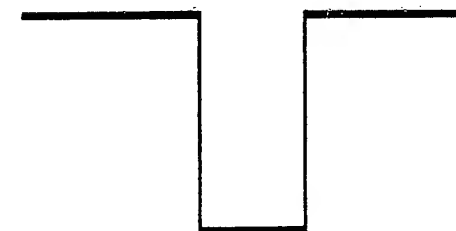
- *Switch off ignition.
Disconnect 8-pole plug connection
and re-measure voltage on
Motronic end (ignition
on).
- *Given positive result, check
lead from intermediate plug
to GS-control unit, eliminate
short to ground if necessary,
otherwise renew GS-control
unit.
- *If voltage less than 3.5 V,
e.g. approx. 0 V, check
lead to Motronic control unit,
eliminate short to ground
if necessary, otherwise renew
Motronic control unit.



- 1 = Two main relays (5-pole)
- 2 = Two pump relays
- 3 = Sensor-heater relay
- 4 = Interface to transmission
control (8-pole)
- 5 = Additional positive terminal

Note: Items 1 and 2 may be
interchanged.

Engine-action signal



261/337

Return to self-diagnosis
test table B18

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (15)

TESTER FAULT CODE: 52
(FLASHING CODE: 1232 / 2232)

Check idle signal.

Switch off ignition.
Detach Motronic control-unit
plug, connect voltmeter to
term.52 (-) and term.18 (+).

Switch on ignition, accelerator
pedal in off position.
Voltmeter must indicate
approx. 12 V.

Slightly actuate accelerator pedal.
Voltmeter must indicate
approx. 0 V.

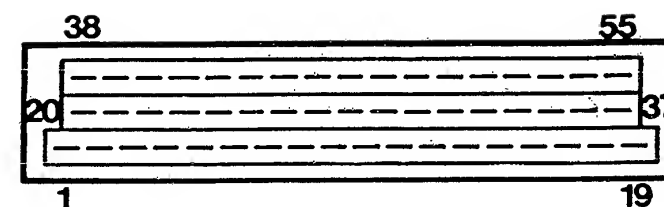
Voltage O.K.?

N>

Check lead from Motronic control
unit term.52 to EMS control
unit term.6 (32)* for open
circuit and short circuit.

Check EMS if there is no open
circuit or short circuit.

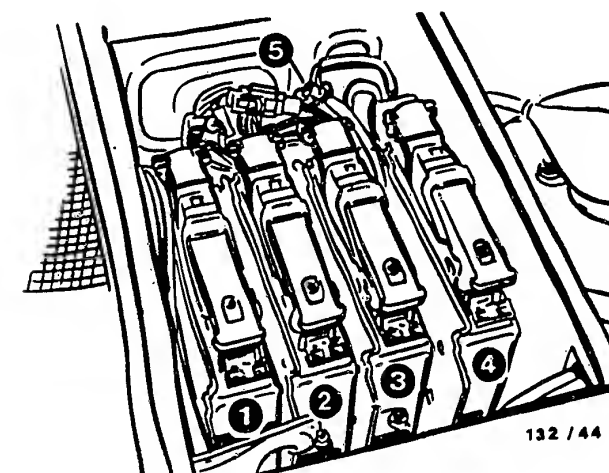
* Number in brackets
applies to Motronic, right.



265/391

Plan view of 55-pin control-unit plug

- 1 = Motronic control unit of right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit



132 / 44

Return to self-diagnosis
test table B18

D09

<=>

D10

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (16)

TESTER FAULT CODE: 53
(FLASHING CODE: 1233 / 2233)

Check full-load signal.

Switch off ignition.
Detach Motronic control-unit plug, connect voltmeter to term.53 (-) and term.18 (+).
Switch on ignition, slowly depress accelerator pedal to full throttle.
Shortly prior to full throttle, reading on voltmeter must switch from approx. 0 V to approx. 12 V.

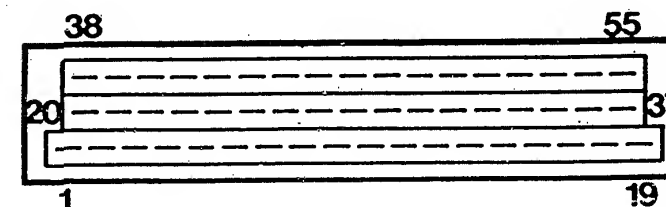
Voltage O.K.?

N>

Check lead from Motronic control unit term.53 to EMS control unit term. 5 (33)* for open circuit and short circuit.

Check EMS if there was no open circuit or short circuit.

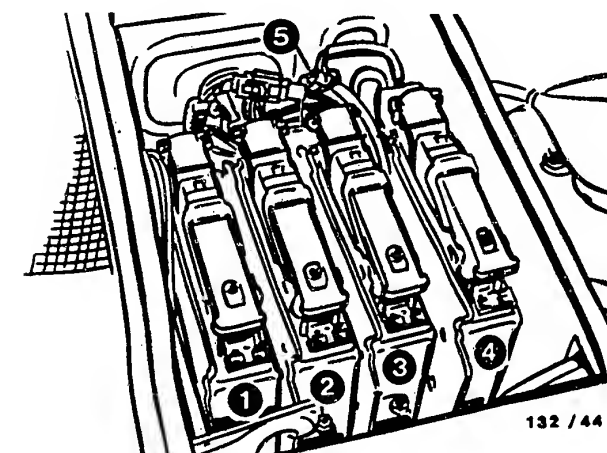
* Number in brackets applies to Motronic, right.



265/391

Plan view of 55-pin control-unit plug

- 1 = Motronic control unit of right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit



132 / 44

Return to self-diagnosis test table B18

D11

<=>

D12

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (17)

TESTER FAULT CODE: 54
(FLASHING CODE: — / —)

Map switching, converter clutch (term.54) constantly active, i.e. term.54 always on ground potential.

Test:

With ignition switched on, measure voltage at connection 3 with respect to ground of 8-pole plug connection for transmission control unit (GS).

Set value: greater than 3.5 V

Is voltage greater than 3.5 V ?

N>

Function, map switching - converter clutch:

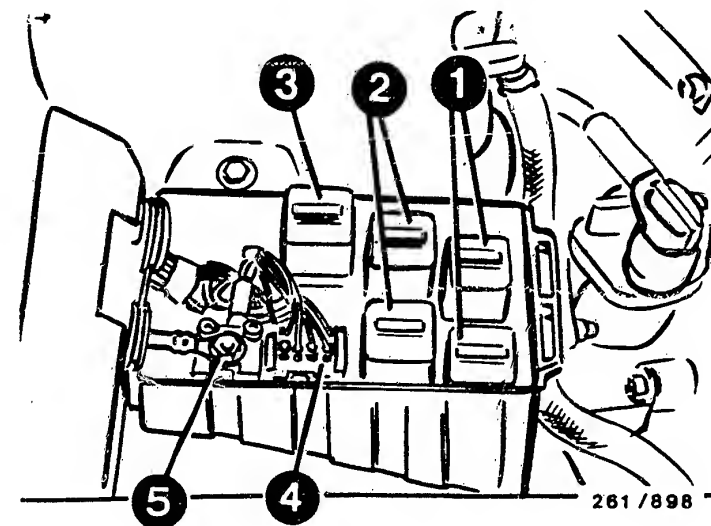
The Motronic is informed of switch-on of the converter clutch (only in 3rd/4th gear) by the transmission control (GS control unit term.25 connected to Motronic control unit term.54).

Corresponding maps in the Motronic are thus activated. Possible causes of trouble with fault code 54:

- *Lead from Motronic control unit via 8-pole plug connection (connection 3) to GS-control unit shorted to ground (worn insulation?)
- *GS control unit defective
- *Motronic control unit defective

Procedure:

- *Switch off ignition. Disconnect 8-pole plug connection and re-measure voltage on Motronic end (with ignition on).
- *Given positive result, check lead from intermediate plug to GS-control unit, eliminate short to ground if necessary, otherwise renew GS-control unit.
- *If voltage less than 3.5 V, e.g. approx. 0 V, check lead to Motronic control unit, eliminate short to ground if necessary, otherwise renew Motronic control unit.



- 1 = Two main relays (5-pole)
- 2 = Two pump relays
- 3 = Sensor-heater relay
- 4 = Interface to transmission control (8-pole)
- 5 = Additional positive terminal

Note: Items 1 and 2 may be interchanged.

Return to self-diagnosis test table B18

TROUBLE-SHOOTING PROGRAM (1)

V

* Check internal resistance engine-speed/reference-mark sensor:

N>

Take apart plug connector to sensor.

Connect ohmmeter to plug to sensor between term. 1 and term. 2.

Set value: See brief instructions

Set value obtained?

V

Continued on next picture page

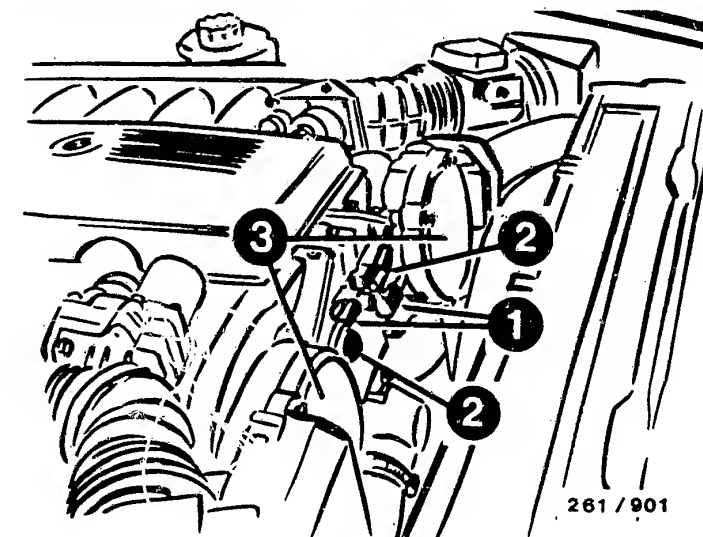
V

Sensor defective -> replace.

Notes on replacement:

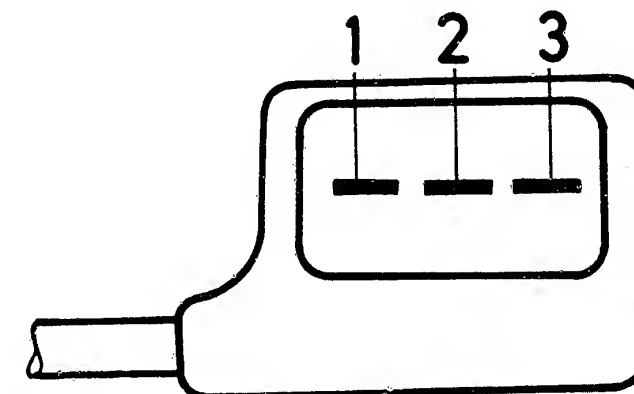
Unscrew fastening screw and withdraw sensor. If stiff, help by turning and with screwdriver.

Do not take sensor out of protective sleeve until just before installation. Before installing the sensor, make sure that there are no metallic parts sticking to the sensor (sensors contain permanent magnets). Grease sensor with Longterm 2. Press sensor by hand into the hole as far as it will go. Do not use force. Do not knock. Make sure that the spring contacts in the plug are correctly seated. Spring contacts must not allow themselves to be pushed back and must be free from corrosion. Plug connector must latch in.



- 1 = Plug connections for engine-speed sensor
- 2 = Plug connections for high-tension sensor
- 3 = High-tension distributor

Top view of plug of engine-speed/reference-mark sensor
Term. 3 = Shielding lead



261/577

Check engine-speed/reference-mark sensor for short circuit to ground (insulation damage):

Switch off ignition.
Disconnect plug from control unit.
Sensor plug connector connected.
Connect ohmmeter to control-unit plug term. 47 and ground.

Set value: Infinity Ω

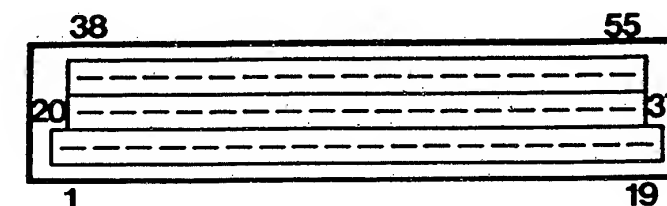
Watch for worn insulation and loose contacts.

Set value obtained?

N>

Disconnect sensor plug connection. Perform resistance measurement consecutively between control-unit plug term.47 and term.48 with respect to ground.

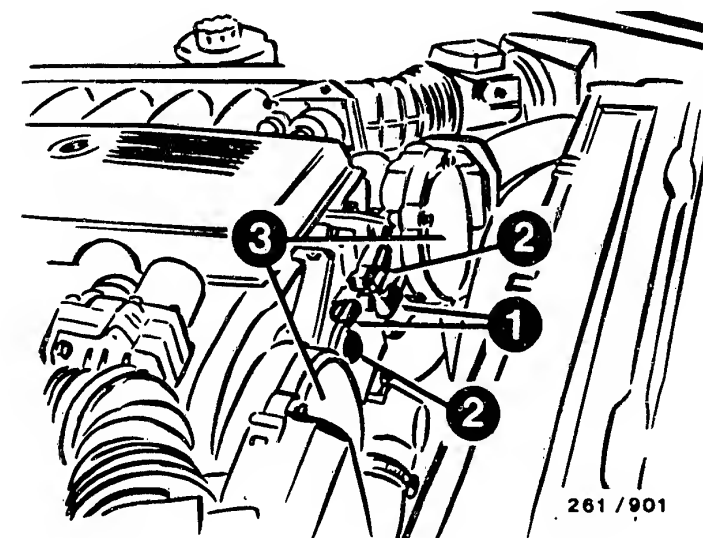
- 1.If set value is not attained, rectify the lead concerned between control and sensor plug.
- 2.If set value is attained for both leads, renew engine-speed/reference-mark sensor.



265/391

Plan view of 55-pin control-unit plug

- 1 = Plug connections for engine-speed sensor
- 2 = Plug connections for high-tension sensor
- 3 = High-tension distributor



261 / 901

Continued on next picture page

V

Check the following leads for open circuit with ohmmeter:

From control-unit plug term. 47 to sensor plug connector term. 1 and from control-unit plug term. 48 to sensor plug connector term. 2.

Set values: approx. 0 Ω

Check plug for corrosion and loose contact.
Contacts must not allow themselves to be pushed back.

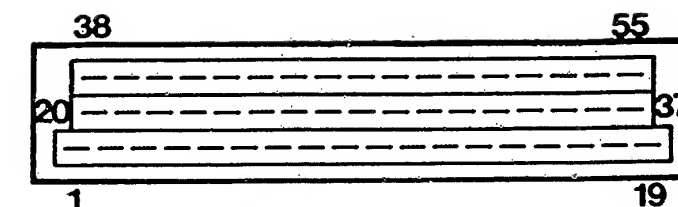
Set values obtained?
Contacts O.K.?

N>

Repair defective lead/plug.

Y

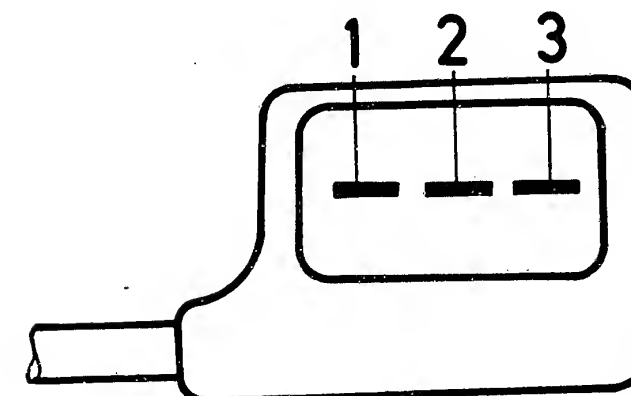
V



265/391

Plan view of 55-pin control-unit plug

Top view of plug of engine-speed/reference-mark sensor
Term. 3 = Shielding lead



261/577

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (1) CONTINUED (3)

Check signal from engine-speed/
reference-mark sensor.

Take apart sensor plug
connector.

Set motortester to special
input.

Lever at left-hand stop
(calibrated voltage range).

Connect special cable to plug
of sensor:

Red tester clamp to term. 1
of sensor plug, black tester
clamp to term. 2 (negative,
center contact).

Start engine.

Set value: See top picture.

Read off voltage.

N o t e:
With the reference-mark
signal, the negative amplitude
must appear first.

Signal O.K.?

N>

1. No signal or signal
too small:

Measuring leads incorrectly
connected.

Cranking speed less than
200 min⁻¹:
Charge battery.

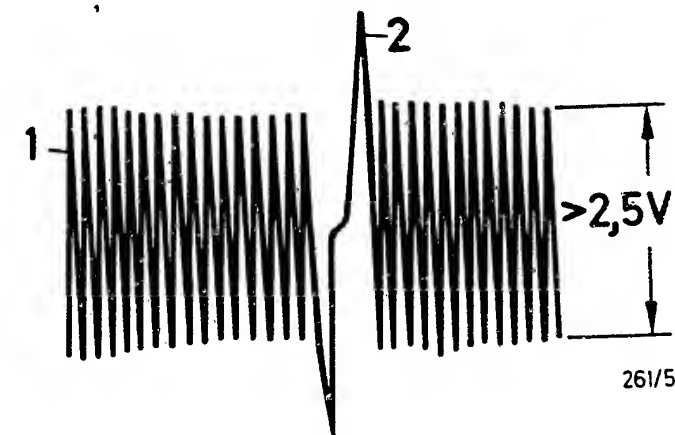
Sensor air gap too big.
Nominal air gap:
0,8 mm ± 0.3.

Sensor mechanically defective,
replace.

2. Incorrect signal:

Ring gear defective.
Note: Reference-mark signal
is formed by several missing
teeth in succession.

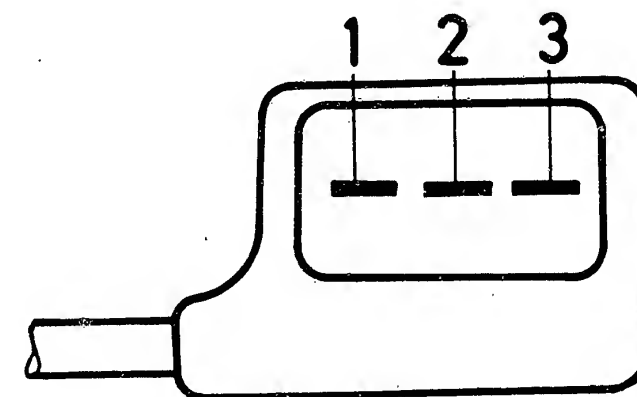
Positive amplitude appearing
first: measuring leads
incorrectly connected or sensor
leads to control unit mixed
up.
Rectify in accordance with
circuit diagram.



261/578

1 = Engine-speed signal
2 = Reference-mark signal

Top view of plug of
engine-speed/reference-mark
sensor
Term. 3 = Shielding lead



261/577

Return to trouble-shooting chart
B03

Continued on next picture page

Sensor defective -> replace.

Notes on replacement:

Unscrew fastening screw and withdraw sensor. If stiff, help by turning and with screwdriver.

Do not take sensor out of protective sleeve until just before installation.
Before installing the sensor, make sure that there are no metallic parts sticking to the sensor (sensors contain permanent magnets).
Grease sensor with Longterm 2.
Press sensor by hand into the hole as far as it will go. Do not use force. Do not knock.
Make sure that the spring contacts in the plug are correctly seated. Spring contacts must not allow themselves to be pushed back and must be free from corrosion. Plug connector must latch in.

Return to trouble-shooting chart
B03

TROUBLE-SHOOTING PROGRAM (2)

Check fuel pressure with engine stopped.

Measure pressure ahead of each pressure regulator. Test measurement points at fuel inlet of each fuel-distribution pipe (hose connections; top picture).

Detach fuel supply hose.

IMPORTANT!

Catch fuel as it emerges; it must not be allowed to get onto hot parts of engine. Connect up pressure measuring device KDJE-P100, close off valve screw. For connection purposes, make use of three-way line KDJE-P100/13 (hose connection) or connection part KDJE-P100/14 (screw connection M14x1.5) or KDJE-P100/16 (M16x1.5). Make sure connection is tight. Detach corresponding pump relay and fit jumper between term.87 and term.30 in frame (for pump relay).

Fuel pressure
SET VALUE: see brief instructions

Is set value attained?

N>

Set value is not attained because corresponding EKP (electric fuel pump) does not run (audible):

1. Check pump fuse No.23 (EKP1) or No.24 (EKP2)

2. Measure voltages at detached plug on fuel tank (bottom picture)

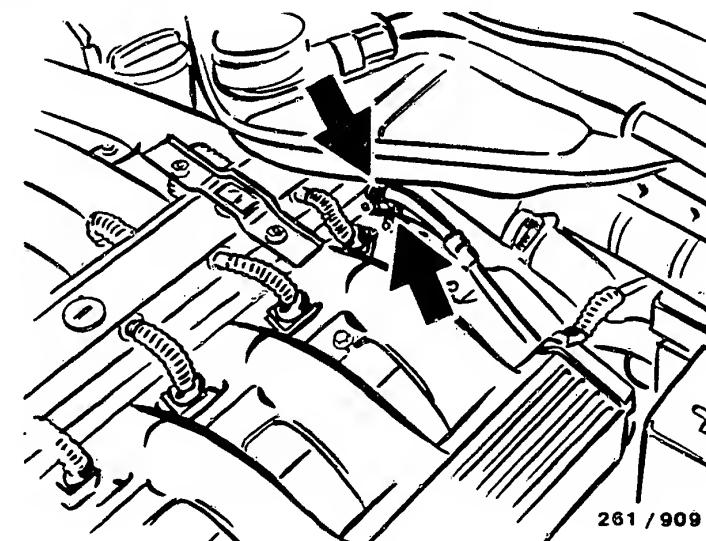
EKP1: term.5(+) / term.4(-)

EKP2: term.6(+) / term.4(-)

*If there is no voltage at one of the EKP: check leads from plug term.5 or term.6 to respective pump relay term.87 as well as pump ground lead (term.4)

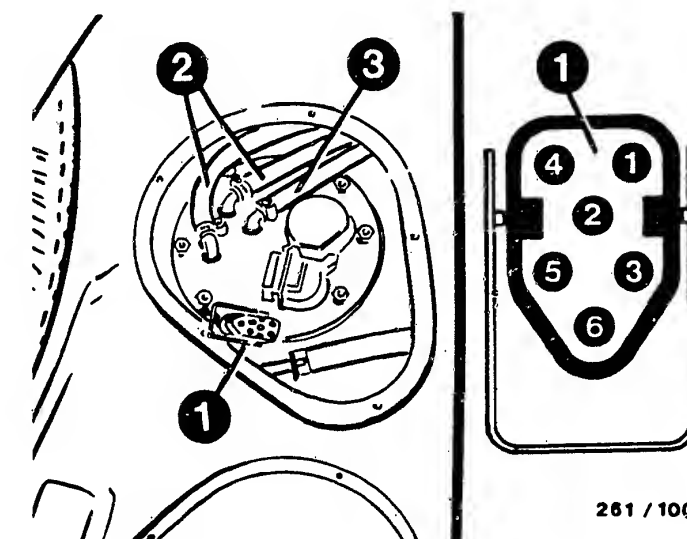
*If voltage is present: Measure resistances of fuel pumps (at mating plug) (term.5 or term.6 with respect to term.4). Set value: approx. 1 Ω each.

3. Perform hydraulic check on pressure regulator and fuel pump (see next picture page).



Arrows = Pressure-gauge connection points for both cylinder banks

Installation position of tandem in-tank electric fuel pump
1 = Connector on fuel tank (in trunk)
2 = Fuel supply lines
3 = Fuel return line



Continued on next picture page

Continued on next picture page

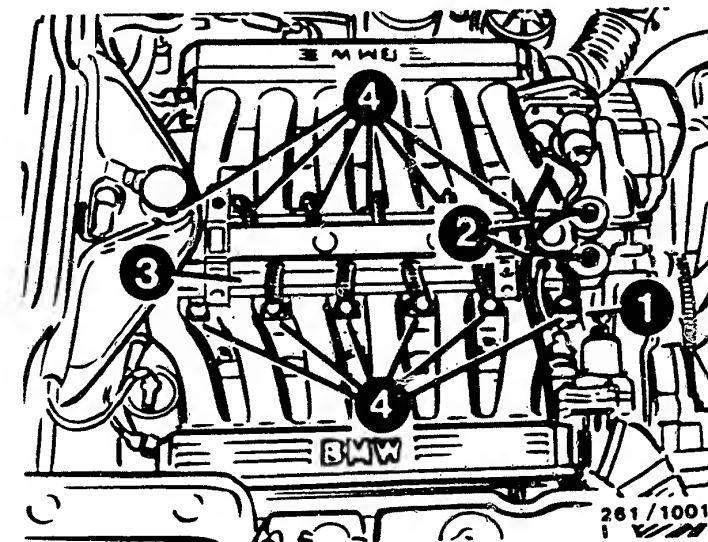
Set value is dropped below:

- * Slowly pinch off fuel return line.
Caution! Pressure must not increase to in excess of 6 bar.
If pressure increases to in excess of 5 bar, renew pressure regulator.
With O-ring sealing technique, use new O-rings.
Apply small quantity of silicon grease (Ft 2 v 1).
If pressure does not increase sufficiently, fuel pump is defective.
- * Fuel filter heavily clogged, renew.
- * Fuel pressure line or pressure damper (if applicable) clogged, renew.
- * Filter in tank clogged.
Corrosion in tank.

Set value is exceeded:

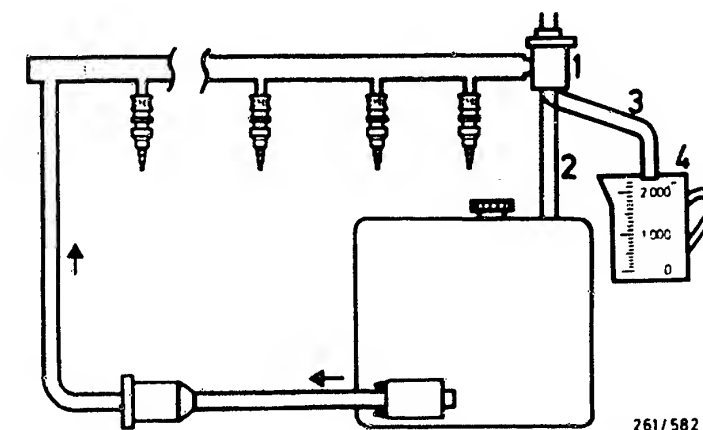
Detach fuel return hose from pressure regulator.
Attach test hose to pressure regulator and route it into a 1.5 l measuring jug.
Is set value now attained?

1. If yes, fuel return line clogged or squashed; renew.
2. If no, pressure regulator defective; renew.



- 1=Fuel return line
(Cyl. 1...6)
2=Manifold-pressure control
of fuel pressure regulators
3=Right-hand fuel-distribution pipe
4=Injection valves

————— Pressureless
||||||| Fuel pressure
1 = Pressure regulator
2 = Return
3 = Test hose
4 = Measuring glass



261/582

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (2) CONTINUED (2)

Following test sequence applies only in the event of fault symptom "engine won't start".

Check whether engine starts with wire jumper in relay frame.

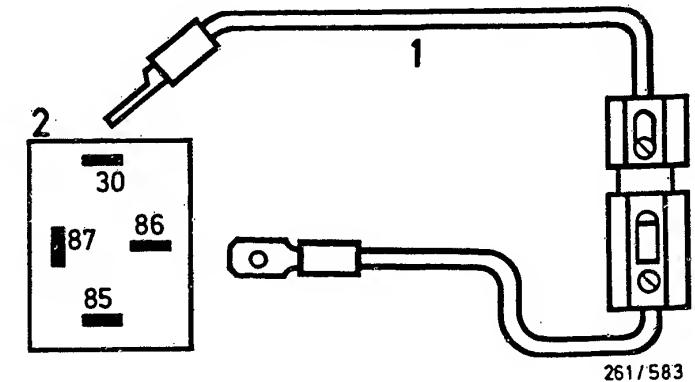
*If not, continue trouble-shooting on next picture page.

*If engine starts, the following are possible causes of the trouble:

1. Open circuit in lead to control unit
term. 3 to pump relay
term. 85 (battery voltage must be present at term. 86 in pump-relay frame with ignition switched on).
2. Pump relay defective.
3. Control unit (pump output stage) defective.

Leads and components O.K.

*Repair lead.
*Replace relay.
*Replace control unit.



1 = Jumper with fuse holder and 10 A fuse (user-fabricated)
2 = Top view of connection base

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (2) CONTINUED (3)

Check fuel pressure with engine running.

Let engine idle.

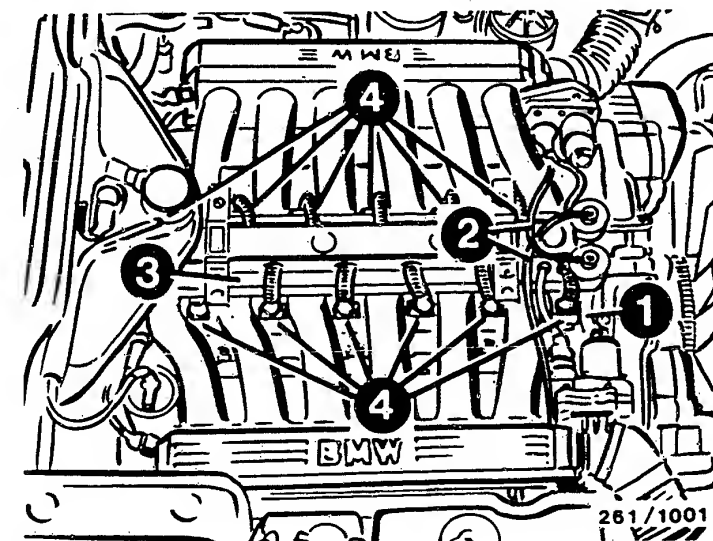
Fuel pressure
SET VALUE: approx. 0.5 bar
lower than with engine stopped.

Set value obtained?

N>

*Intake manifold pressure energization of pressure regulator not O.K. Hose line between pressure regulator and intake manifold clogged or leaking → replace.
Hose line dropped off → re-connect.

*If intake manifold pressure energization O.K. → replace pressure regulator.



- 1=Fuel return line
(Cyl. 1...6)
- 2=Manifold-pressure control
of fuel pressure regulators
- 3=Right-hand fuel-distribution pipe
- 4=Injection valves

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (2) CONTINUED (4)

Check fuel pressure after switching off engine (checking for leaks).

Fuel pressure
SET VALUE: min. 1.0 bar
after 20 minutes.

Set value obtained?

N>

*Leaking at joints between components, fuel hoses and fuel lines → tighten hose binder or replace hose.

*Pressure regulator (diaphragm) leaking → replace.

*Electric fuel pump (non-return valve) leaking.
With screw-type non-return valve → replace.
With integral non-return valve → replace electric fuel pump.

*Pressure damper or fuel filter leaking → replace.

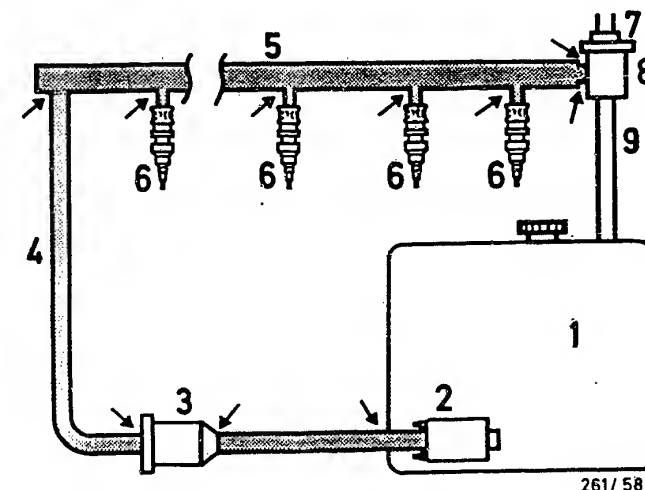
After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove pressure tester.
Connect fuel-inlet hose to fuel-distribution pipe.
Make sure there are no leaks.

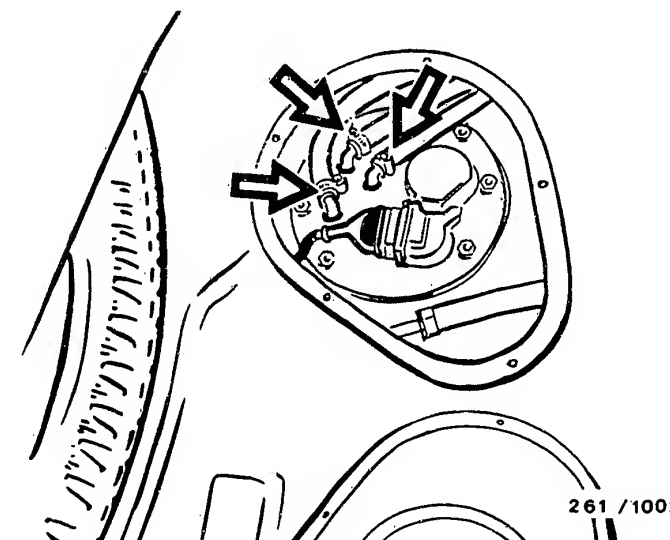
Return to trouble-shooting chart B03

Continued on next picture page



- 1 = Fuel tank
- 2 = Electric fuel pump
- 3 = Fuel filter
- 4 = Inlet, delivery line
- 5 = Fuel-distribution pipe
- 6 = Injection valves
- 7 = Intake-manifold pressure connection
- 8 = Pressure regulator
- 9 = Return line

Arrows = Possible leaks



*Leak in injection valve(s)
at point of connection with
fuel distributor; renew
O-ring. See text below.

*Check injection valve(s)
(needle seat) for leaks:

Remove complete fuel distributor.
Supply and return remain
connected. Simultaneously
pull all injection valves
out of intake-manifold guide.

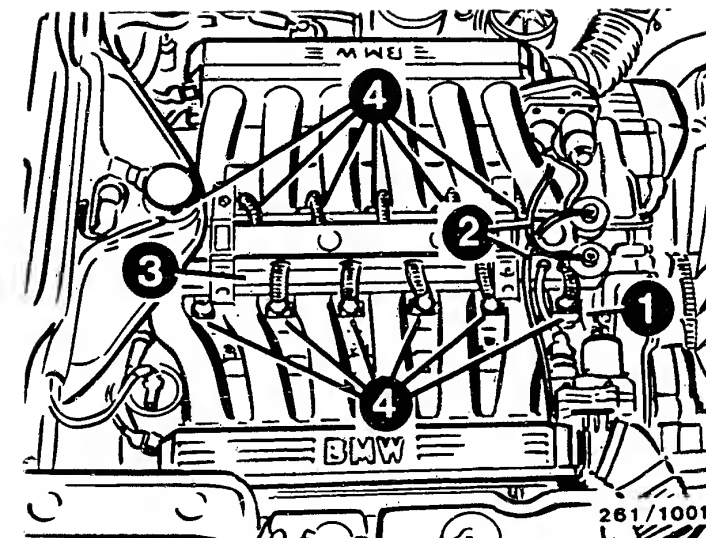
Fit jumper between term. 87
and term. 30 in connection
frame (pump relay).
Electric fuel pump must
run.

Set value:

No droplets may drip off the
injection valve within 60 s.
If they do so, renew injection
valve.

Removal:

Detach connector.
Pull out retaining clip.
Remove injection valve.
Caution!
Catch any fuel which emerges.
It must not be allowed to make
contact with hot engine components.



- 1=Fuel return line
(Cyl. 1...6)
- 2=Manifold-pressure control
of fuel pressure regulators
- 3=Right-hand fuel-distribution pipe
- 4=Injection valves

Continued on next picture page

If injection valve (needle seat) is leakproof but O-ring is defective, then renew O-ring.

Use new parts set.
Caution! Do not damage protection sleeve and valve needle.

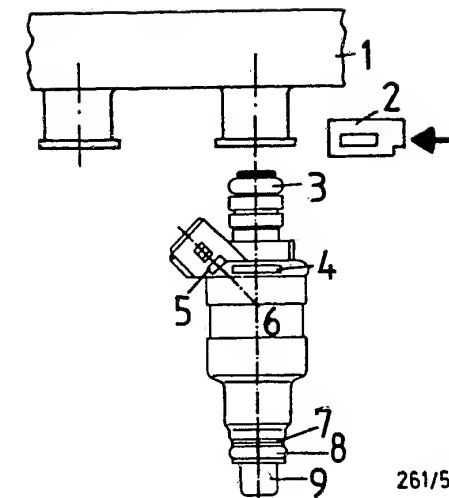
Renew upper O-ring (fuel distributor) if it is damaged.

Cut up lower O-ring (intake manifold) if it is defective.
Fit new O-ring over protection sleeve and its beading.

Installation:

Only grease O-rings slightly (silicone grease Ft 2 v 1).
Attach injection valve to fuel distributor.
Slip retaining clip into groove and allow it to engage.
Check for fuel leaks.
Fit connector.

Install complete fuel distributor.
In doing so, press all injection valves evenly into intake-manifold guide.
Caution!
Do not damage O-rings and/or valve needles.
Make sure there are no intake-manifold leaks.



261/585

- 1 = Fuel-distribution pipe
- 2 = Holding clamp
- 3 = Upper O-ring
- 4 = Part number
- 5 = Date of manufacture
- 6 = Injection valve
- 7 = Supporting plate
- 8 = Lower O-ring
- 9 = Protective sleeve

Return to trouble-shooting chart
B03

TROUBLE-SHOOTING PROGRAM (3)

Check fuel delivery.

Measure fuel delivery of electric fuel pump against pressure. Therefore, measuring point at return, after pressure regulator.

Disconnect fuel-return hose from pressure regulator.
Mount test hose on pressure regulator and lead into a 1.5 l measuring glass.
Disconnect pump relay.
Connect jumper into connection base between term. 87 and term. 30.
The electric fuel pump must operate. Measuring time 30 sec.

Fuel delivery
SET VALUE: See brief instructions
Set value obtained?

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove test hose and mount fuel return hose on pressure regulator. Make sure there are no leaks.

Return to trouble-shooting chart B03

N>

*Fuel filter heavily clogged, renew.

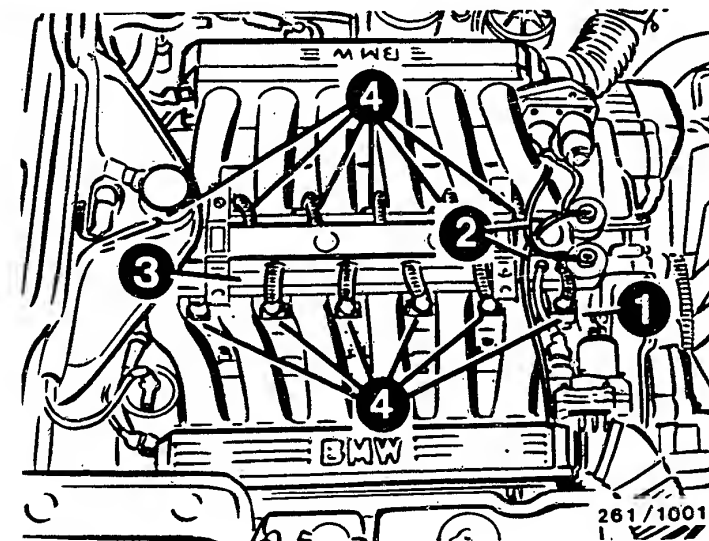
*Fuel delivery tubing or pressure damper (if provided) clogged, renew.

*Check voltages at plug to electric fuel pumps with engine running (bottom picture).
To do so, push back rubber sleeve (arrow) and measure on plug at rear with suitable test prods,
EKP1: term.5(+) / term.4(-)
EKP2: term.6(+) / term.4(-)
SET VALUE: min. 12 V
If not, clean contacts, eliminate poor ground connections, renew leads.

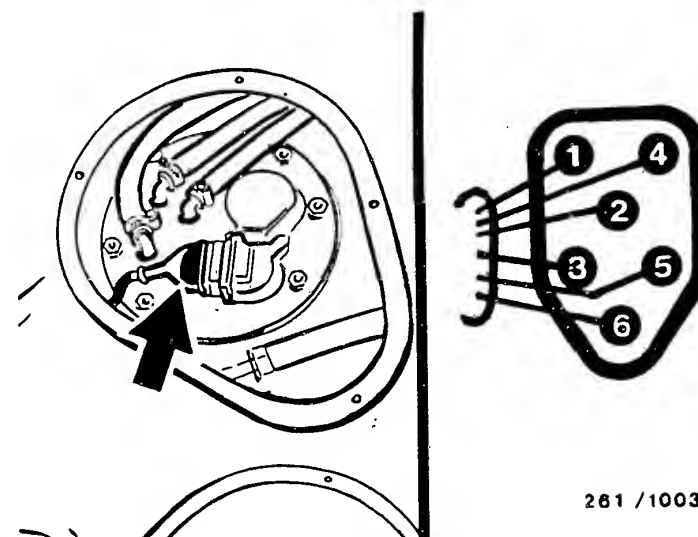
*If fuel pump delivery inadequate, renew electric fuel pump.
Clean connection points before loosening, so that no dirt can ingress into the fuel system. In-tank electric fuel pumps are accessible by means of a closure on the tank.

*In the event of a noisy electric fuel pump (vapour bubbles), intake line is constricted or kinked and should be renewed.
Filter in tank clogged, renew.
Corrosion in tank, clean or renew.

*Pressure regulator defective, check.



- 1=Fuel return line (Cyl. 1...6)
- 2=Manifold-pressure control of fuel pressure regulators
- 3=Right-hand fuel-distribution pipe
- 4=Injection valves



Check solenoid-operated injection valves with engine running (remove cover over injection valves before starting engine).

1. Lambda-controlled engine:

With engine and catalytic converter at operating temperature, measure CO at tailpipe when idling (approx. 0...0.2 vol. %). Detach solenoid-operated injection-valve plug from solenoid-operated injection valve, wait approx. 10 seconds and re-connect plug.

SET VALUE:

CO increases briefly and drops back to original CO value.

2. Engine without Lambda control:

With engine at operating temperature, measure CO when idling and adjust if necessary. Detach solenoid-operated injection-valve plug from solenoid-operated injection valve and wait approx. 10 seconds. SET VALUE: CO decreases.

Note:

CO increases to original value again after re-connecting plug.

Repeat test for each solenoid-operated injection valve.
Are set values attained?

No change in CO →

*Check solenoid-operated injection valve with ohmmeter. Set value: see brief instructions. If applicable, renew defective injection valve.

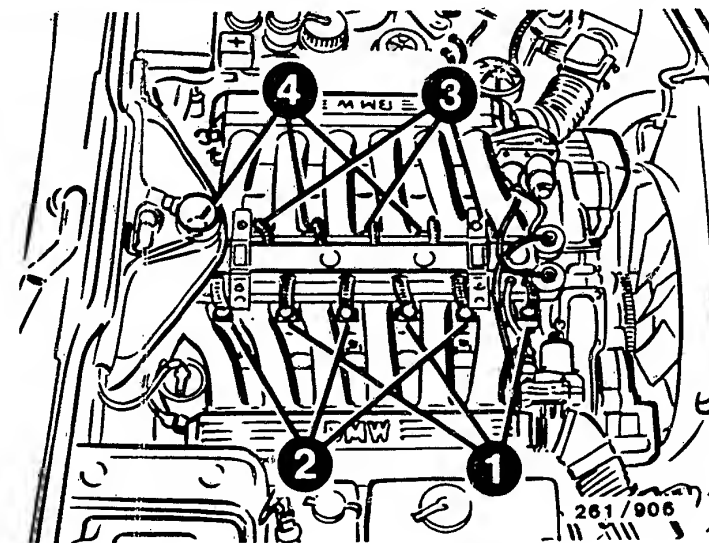
*Measure voltage at injection-valve plug with ignition switched on.

Battery voltage must be measured between one of the two spring contacts in the injection-valve plug and vehicle ground; if not, check positive lead from injection-valve plug to corresponding main relay term.87 (see terminal diagram in brief instructions) for continuity.

*Check negative lead from injection-valve plug to control unit (proceed in accordance with terminal diagram in brief instructions).

Repeat test for each solenoid-operated injection valve.

*If signal present at solenoid-operated injection valve (see further in trouble-shooting program), renew injection valve (mechanical defect).
If there is no signal, control unit (injection output stage is defective and is to be renewed).



- 1 = Injection-valve plug (Cylinders 1, 3, 5)
- 2 = Injection-valve plug (Cylinders 2, 4, 6)
- 3 = Injection-valve plug (Cylinders 7, 9, 11)
- 4 = Injection-valve plug (Cylinders 8, 10, 12)

Continued on next picture page

Measure signal at solenoid-operated injection valve.
Check function and interference.

Connect two-pole test lead 1 684 463 093 between one solenoid-operated injection valve and its connector.
Connect engine tester (special input) to test lead. Connect black clip to vehicle ground. Connect red clip to one of the two connections of the test lead.

Start engine or let it run.

Given proper connection, injection pulses are visible on oscilloscope.

If no pulse is visible, connect red clip of tester to other connection of test lead.

Detach the two other injection-valve plugs of the injection group (3 injection valves per group; see special features).

Example:

Test signal at injection valve of cyl.1 with plugs of cyl. 3 and 5 disconnected etc.

Correct injection signal ?

N>

*No injection signal visible:

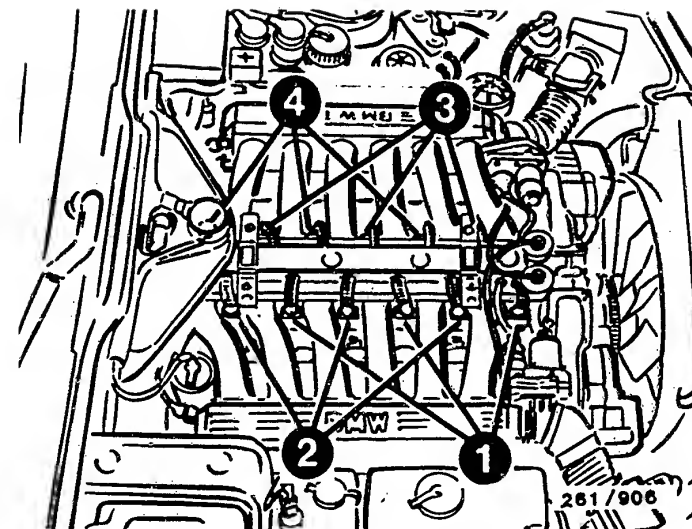
Check leads from injection valves to main relay term.87(+) and to control unit term.16 and term.17 for continuity. If leads are O.K., control unit defective.

*In the event of interference, check cable installation, i.e. check spacing of H.T. ignition cables from wiring harness. Also check generator (e.g. worn carbon brushes) and generator regulator.

*In the event of misfiring, check all injection-valve plugs and all other connections:

Spring contacts in plug must be locked in place and it must be impossible to push them back. Contact surfaces must be bare.

Move connections with engine running and watch for misfiring.



- 1 = Injection-valve plug (Cylinders 1, 3, 5)
- 2 = Injection-valve plug (Cylinders 2, 4, 6)
- 3 = Injection-valve plug (Cylinders 7, 9, 11)
- 4 = Injection-valve plug (Cylinders 8, 10, 12)

Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (5)

Check idle signal

Detach Motronic control-unit plug, connect voltmeter to term.52 (-) and term.18 (+)

Switch on ignition, accelerator pedal in off position:
Voltmeter must indicate battery voltage.
Slightly actuate accelerator pedal:
Voltmeter must indicate approx. 0 V.

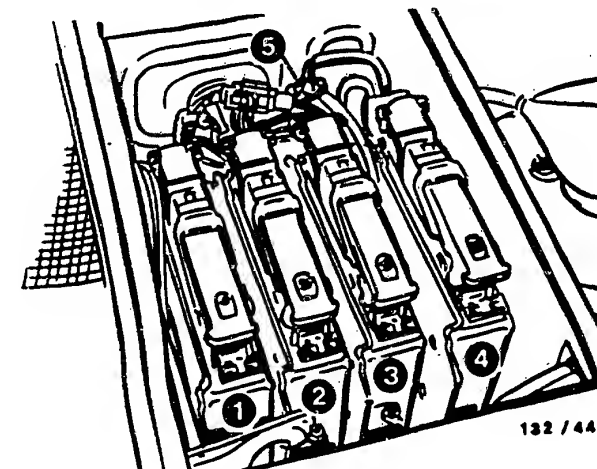
Voltages O.K.?

N>

Check lead from Motronic control unit term.52 to EMS control unit term.6 (32)* for open circuit and short circuit.

Check EMS if there was no open circuit or short circuit.

*Number in brackets applies to Motronic, left.



- 1 = Motronic control unit of right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit

Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (6)

Check full-load signal

Detach Motronic control-unit plug, connect voltmeter to term.53 (-) and term.18 (+). Switch on ignition, slowly depress accelerator pedal as far as full throttle. Shortly prior to full throttle, reading on voltmeter must switch from approx. 0 V to approx. 12 V.

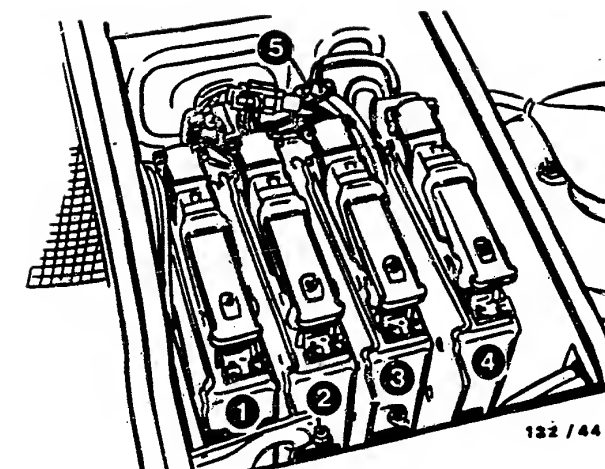
Voltages O.K.?

N>

Check lead from Motronic control unit term.53 to EMS control unit term.5 (33)* for open circuit and short circuit.

Check EMS if there was no open circuit or short circuit.

*Number in brackets applies to Motronic, left.



- 1 = Motronic control unit of right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit

Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (7)

Check injection signal (t_i) for EMS.

Detach EMS control-unit plug, connect oscilloscope special input as follows:
Red clip to term.49 (50)*, black clip to ground.

Start engine.
Signal, see top picture.

*Number in brackets applies to injection signal of Motronic, left.

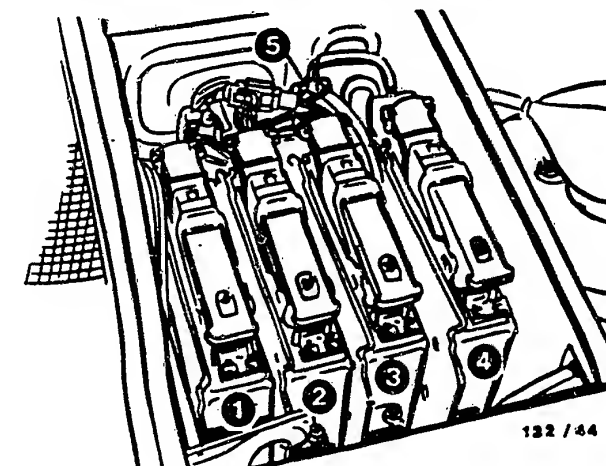
Signal O.K.?

N>

Check lead from Motronic control unit term.17 to EMS control unit term.49 (50)* for open circuit and short circuit.

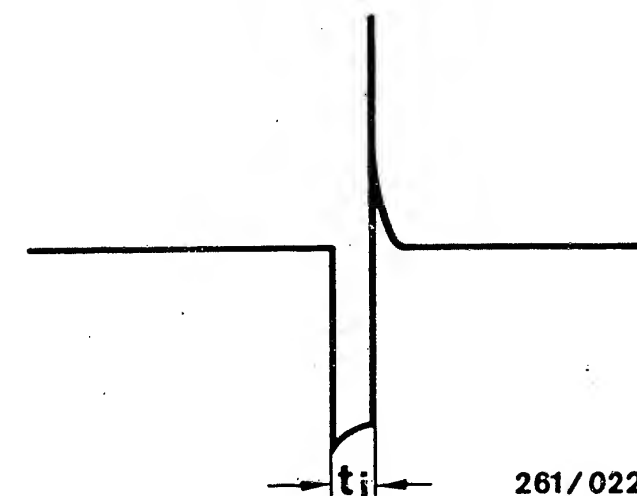
Renew Motronic control unit if there was no open circuit or short circuit.

*Number in brackets applies to Motronic, left.



- 1 = Motronic control unit of right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit

Injection signal
 t_i = Duration of injection



Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (8)

Check engine-speed signal (t_d) for EMS.

Detach EMS control-unit plug, connect oscilloscope special input as follows:
Red clip to term.47,
black clip to ground.

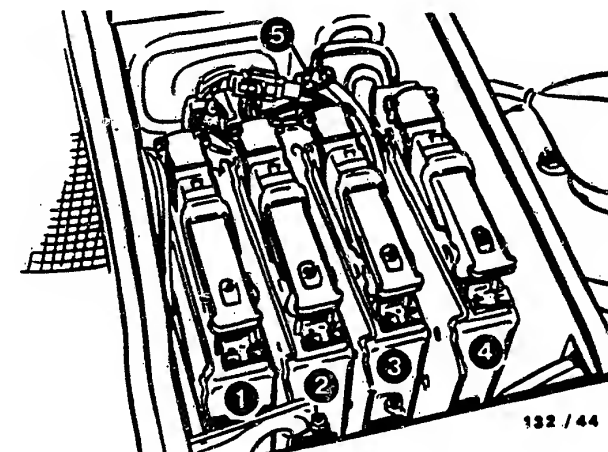
Start engine.
Signal, see top picture.

Signal O.K.?

N>

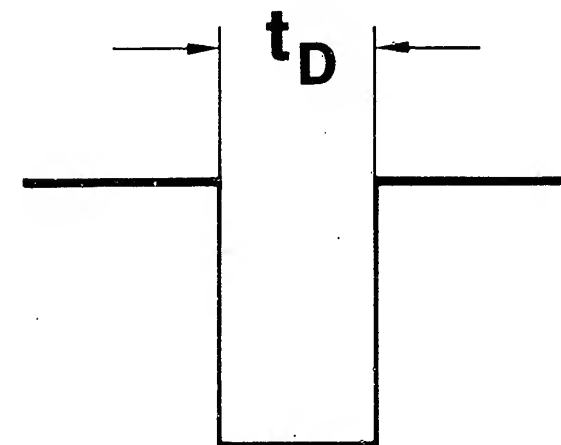
Check lead from Motronic control unit term.6 to EMS control unit term.47 for open circuit and short circuit.

Renew Motronic control unit if there was no open circuit or short circuit.



- 1 = Motronic control unit of right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit

Dwell-period signal
 t_D = dwell period



Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (9)

↓

Check air-intake system

Check whether hoses of air-intake system are correctly connected, not kinked or damaged.

Check whether oil dipstick has been inserted as far as it will go and whether the seal on the oil filler-neck cap is O.K.

With catalytic-converter models, check also that the tank-ventilation system (if applicable) is not leaking (visual examination).

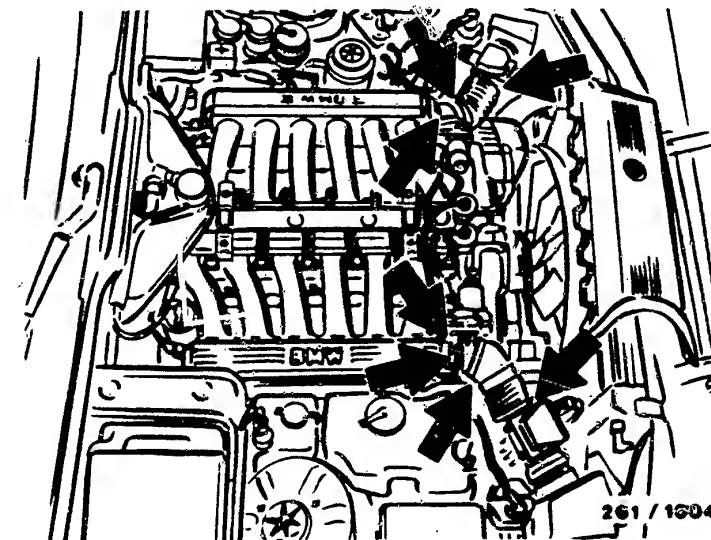
Are all hoses O.K.?

N>

Replace hoses if necessary. Eliminate leaks by means of new seals or by retightening the hose clamps.

↓

Continued on next picture page



Arrow = Sealing points of air-intake system

Leak test on air-intake system.

N>

Eliminate leaks by means of new seals or by retightening the hose clamps.

Leaks may also occur at the following points: oil dipstick not securely inserted, defective seal at oil filler-neck cap etc.

Seal off tailpipe.
Unscrew air-mass meter from air-filter housing and seal off air-mass-meter duct.

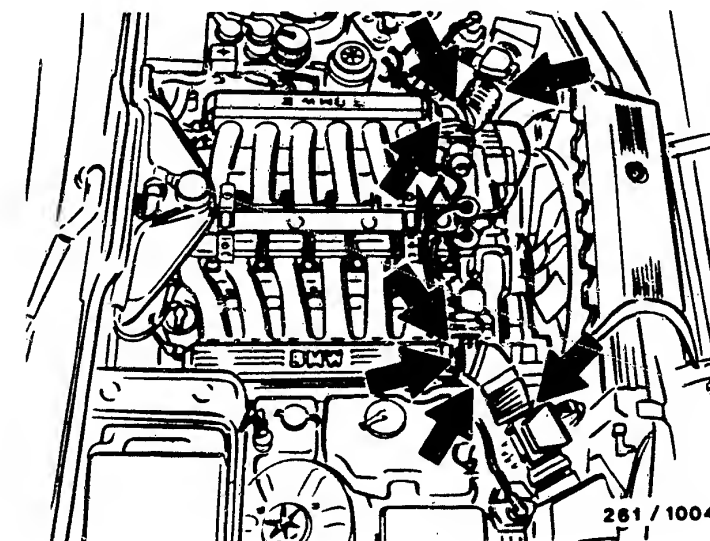
Use compressed-air gun to blow air (0.3 bar gauge) into intake manifold at suitable location (e.g. via air hose of fuel pressure regulator).

Spray or brush over all seals with leak detector spray or soapy water.

Bubbles or foam give an indication of leaks.

Note: perform test for both cylinder banks.

Are all locations leakproof?



Arrow = Sealing points of air-intake system

Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (10)

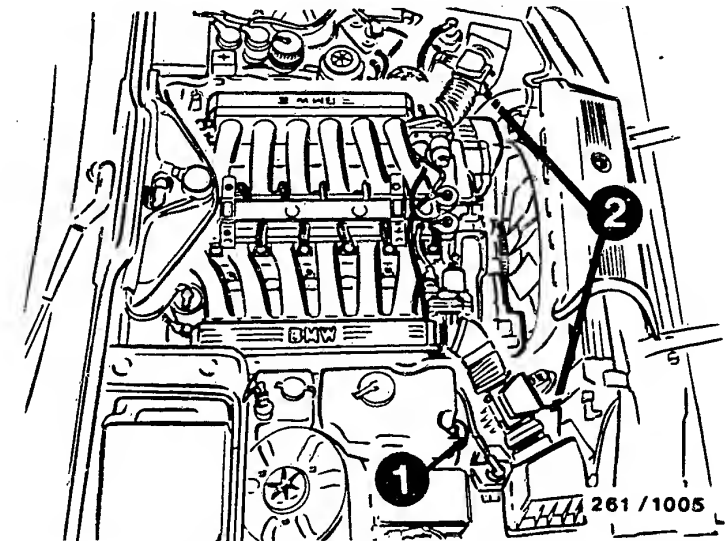
Check tank-ventilation system.

Check visually whether hoses of tank-ventilation system are correctly attached, not bent or damaged.
Check whether hose connections at intake manifold, tank bleeder valve, active-carbon canister and fuel tank are leak-tight.

Are all hoses and connections O.K.?

N>

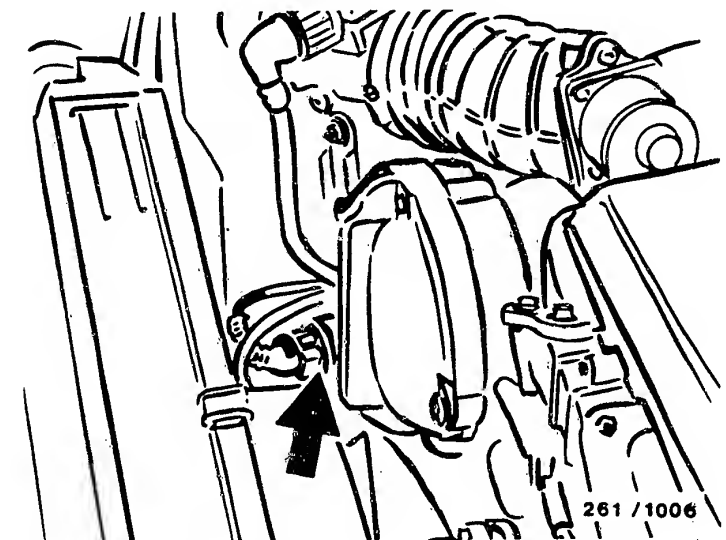
Replace defective hoses as necessary.
Eliminate leakages by tightening hose clamps.



1=Active-carbon container (beneath water tank)

2=Two tank ventilation valves (attached to insides of air filter housings)

Arrow = Plug to tank ventilation valve of right-hand cylinder bank



Continued on next picture page

Function and freedom from
leaks of tank ventilation valves

N>

*Clocking of both tank
ventilation valves must
be felt with engine running.

*To check for leaks, remove
tank ventilation valve.
Connect vacuum pump (e.g.
Mityvac) to valve connection
on intake manifold end
(center picture; item 2 and
bottom picture).

1. No vacuum build-up is
possible when valves
are deenergized.
2. Actuate valve with battery
voltage (12 V) making
use of connecting lead
KDJE-7450/70.
Generate vacuum of approx.
0.5 bar. Vacuum slowly
decreases if tank ventilation
valve is intact.
Guide value: drop in
vacuum from 0.5 to 0.25
bar permissible in approx.
10 seconds at 12 V.
3. Valve deenergized.
Seal other connection,
build up vacuum of approx.
0.5 bar. There must
be no decrease in
vacuum.

Do valves satisfy all
requirements?

Y

V

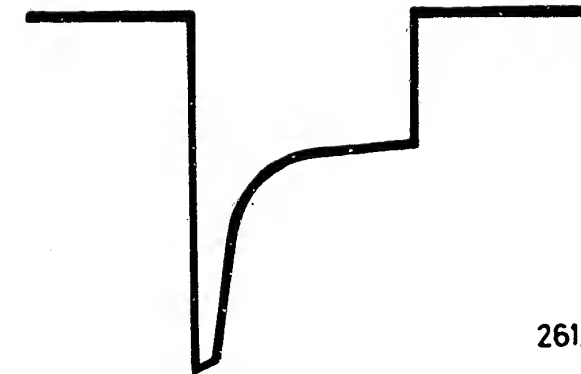
Return to trouble-shooting chart
B03

1. Detach plug from
valve.

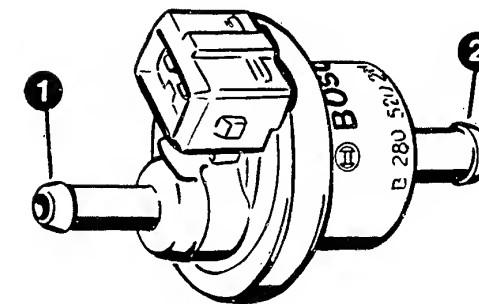
Check internal resistance:
SET VALUE see brief
instructions.

If set value is not
obtained, replace tank
bleeder valve, otherwise
continue test with 2.

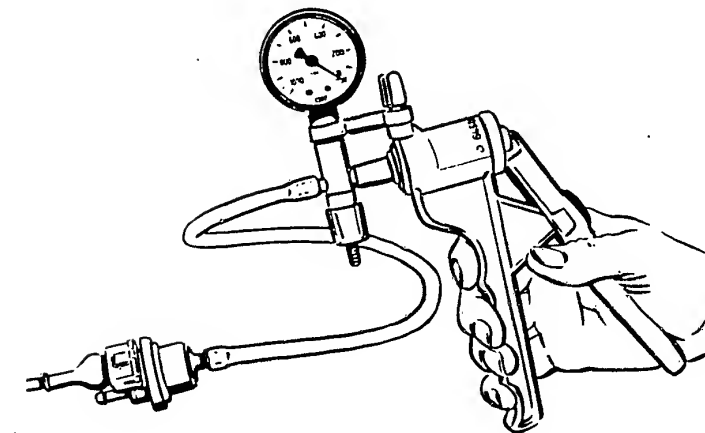
2. With the aid of test lead
1 684 463 093 test
activation of valve (on/off
ratio is dependent on
engine speed and load).
Pulses must be visible
at idle on oscilloscope
(special input)
(bottom picture).
If no signal, check plug
and lead to control unit,
otherwise control
unit is defective.



261/594



261 / 592



261 / 593

TROUBLE-SHOOTING PROGRAM (11)

Check stop-lamp/brake-safety switch and accelerator-pedal switch (in pedal-position sensor).

Note: applies only to vehicles with EMS.

Switch off ignition.
Detach EMS and both Motronic control-unit plugs.
Connect voltmeter to respective Motronic control-unit plug term.52 (-) and term.18 (+).

Voltmeter must indicate approx. 0 V.

Actuate brake pedal (brake safety switch closes),
voltmeter must indicate approx. 12 V.

Slightly actuate accelerator pedal (accelerator pedal switch opens), do not release brake pedal!
Voltage must drop from approx. 12 V to approx. 0 V.

Voltage values O.K.?

Return to trouble-shooting chart B03

N>

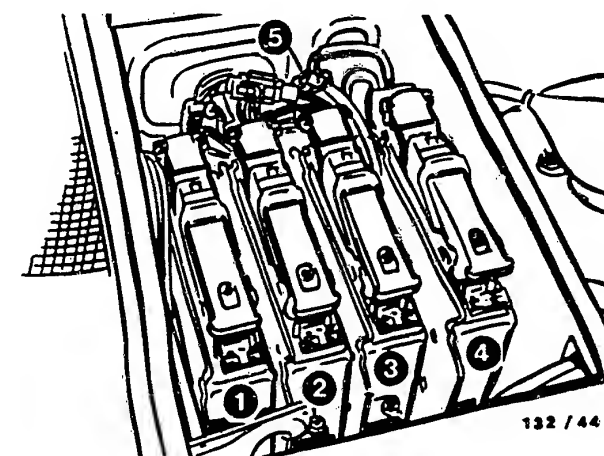
INFORMATION ON FUNCTION OF BOTH SWITCHES:

The brake safety switch is a N/O contact between vehicle ground and the Motronic control units (term.52). It is thus ensured that - in the event of a fault in the EMS system - the Motronic detects an idle signal as a result of brake actuation and goes over to overrun cutoff (term.52 to ground). The accelerator pedal switch is installed in the pedal position sensor and connected between the brake safety switch and the two Motronic control units. On accelerating, it opens the lead to the brake safety switch and thus makes it possible to continue driving in the event of a defective brake safety switch (continuous ground).

TROUBLE-SHOOTING PROCEDURE:
Check lead from Motronic 1 (2) control-unit plug term.52 to pedal position sensor term.5 (term.2), from pedal position sensor term.3 to brake safety switch and from the latter to ground for open circuit and short circuits.

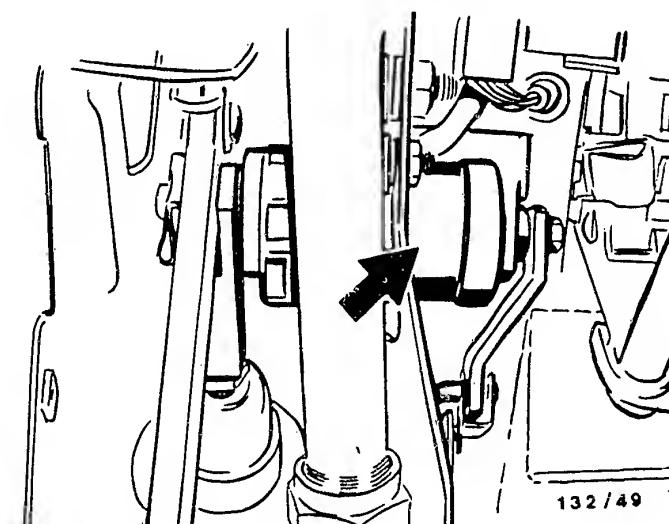
Renew brake safety switch/ pedal position sensor if leads are O.K.

In the event of malfunction, renew respective switch; eliminate open circuits.



- 1 = Motronic control unit of right-hand cylinder bank
- 2 = EMS control unit
- 3 = Motronic control unit of left-hand cylinder bank
- 4 = ABS/ETC/MSR control unit

Arrow = pedal position sensor (footwell, left)



TROUBLE-SHOOTING PROGRAM (12)

V

Check driving-position switch.

Connect voltmeter to Motronic control-unit plug term.42 (+) and term.19 (-).

Switch on ignition.

Voltage value in selector-lever position P or N: approx. 0 V

In all other positions: approx. battery voltage.

Voltage values O.K.?

N>

Check lead from control unit term.42 to driving position switch for open circuit and short circuit.

Check electronic transmission control if there was no open circuit and short circuit.

V

Return to trouble-shooting chart B03

F07

<==>

F08

<==>

TROUBLE-SHOOTING PROGRAM (13)

Check overrun cutoff:

Remove cover from over injection valves.
Set engine tester to special input.
Black clip to vehicle ground.
Allow engine to idle.

NOTE :

In view of the fact that the terminal assignments of the injection-valve plugs are not standard, the negative lead of the injection valve must be determined. To do so, first connect red clip of engine tester to one lead (use test lead or test prods, avoid short circuit).

If no injection pulses are visible, connect red clip to other lead. Run engine at 3000 min⁻¹. Injection signals are visible (see top picture). Suddenly release accelerator pedal.

With decreasing engine speed, injection signals are suppressed and cut in again above the idle speed.

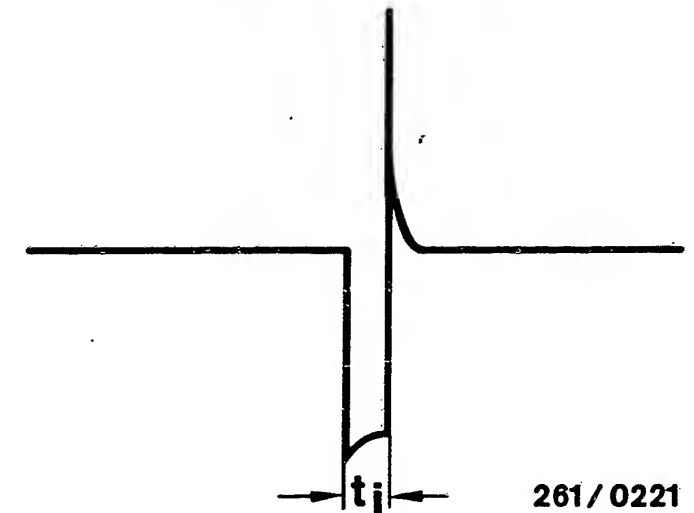
Signals O.K.?

N>

* Repeat test.

* Check idle signal of EMS control unit.
(Check idle contact in the case of vehicles with no EMS).

* Motronic control unit defective.



261 / 0221

Return to trouble-shooting chart
B03

F09

<==>

F10

<==>

TROUBLE-SHOOTING PROGRAM (14)

Test ignition coil.

Remove protective cap from ignition coil.

Ignition coil, primary, term. 15 and term. 1
(Take account of resistance of test lead/test prods)

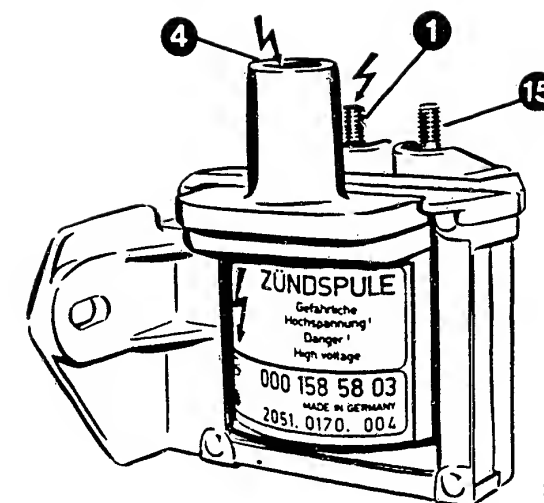
Set value: see brief instructions

Ignition coil, secondary, term. 1 and term. 4

Set value: see brief instructions

Is set value attained?

Renew ignition coil.



227 / 896

High-tension arrows:
Caution, 400 V...25 kV

Return to trouble-shooting chart B03

F11



F12



TROUBLE-SHOOTING PROGRAM (15)

Check primary signal.

Connect oscilloscope to
ignition coil term. 1.
Motronic control unit
connected.

Disengage gear or set
selector lever to N or P.

Start engine.

750i: Perform test at
both ignition coils.

SET VALUE:

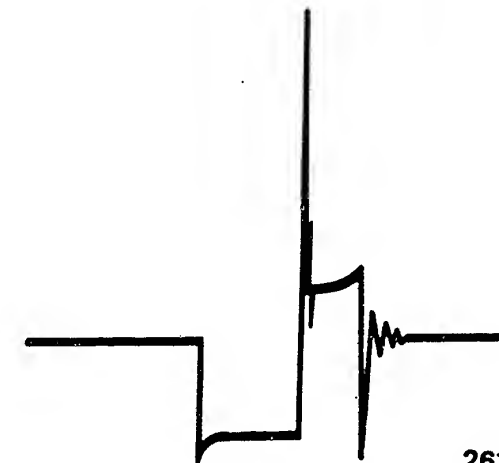
Primary signal must be
present (see top picture).

Primary signal present?

N>

* Check leads from the two
ignition coils (term.1)
to respective Motronic
control unit (term.1) for
short circuit to ground
and continuity.

* Replace control unit if
lead O.K.
Prerequisite: voltage
supply for control unit
present and engine-speed/
reference-mark signal O.K.
as well as appropriate
ignition coil checked.



261 / 0212

Primary signal

Return to trouble-shooting chart
B03

TROUBLE-SHOOTING PROGRAM (16)

Check secondary patterns of all cylinders and interference-suppression resistors.

SET VALUES for interference-suppression resistors:
see brief instructions

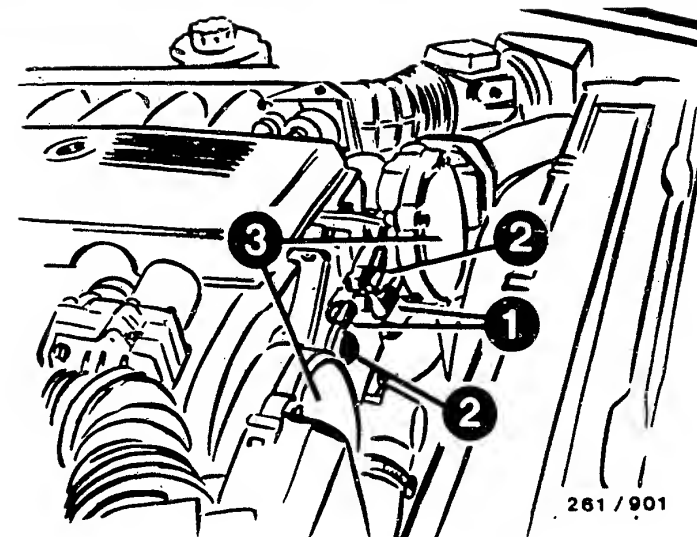
Secondary patterns and interference-suppression resistors O.K.?

N>

*Outside and/or inside of distributor cap oil fouled?
Scorch marks visible?

*Check interference-suppression resistors, ignition cables and spark plugs.

*When plugging on the ignition cables, note the cylinder numbers.
Do not forget hood and screening cover.



1 = Plug connections for engine-speed sensor

2 = Plug connections for high-tension sensor

3 = High-tension distributor

Return to trouble-shooting chart B03

TROUBLE-SHOOTING PROGRAM (17)

Check ignition angle.

Connect BMW diagnosis cable
(No. 1 684 463 196) and
engine tester.

Bring engine up to operating
temperature (oil temperature
in excess of 60° C).
Switch off all loads.

Idle speed must have prescribed
set value (see brief instructions),
otherwise a different
ignition angle is indicated.

SET VALUE for ignition angle:
see brief instructions

Is set value attained?

N>

* Idle speed correct?

* Idle signal from EMS control
unit present or idle
contact closed in the
case of vehicles with no
EMS?

* Engine-speed/reference-
mark signal O.K?

* Control unit defective.

Return to trouble-shooting chart
B03

TROUBLE-SHOOTING PROGRAM (18)

Check self-cleaning function of hot-wire air-mass meter (HLM).

- * Hot wire must be visible (remove rubber connecting piece between HLM and throttle-valve assembly, remove HLM if necessary, however do not detach plug).
- * Briefly run engine at operating temperature at speed in excess of 2000 min ⁻¹. Switch off engine.
- * 2.5 seconds following engine stoppage, hot wire glows for approx. 1 second.
- * 750i: Perform test for both air-mass meters.

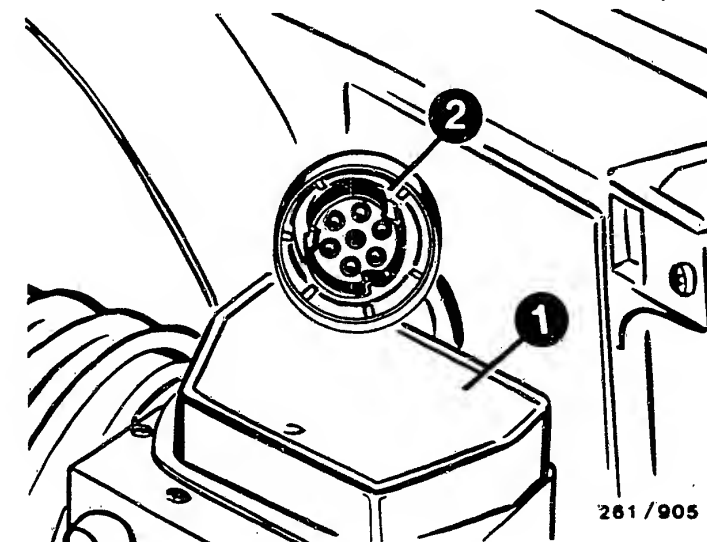
Self-cleaning function O.K.?

N>

Hot wire does not glow:

1. Check lead from control unit term.25 to air-mass meter term.1 for open circuit and short to ground.
2. Detach plug of air-mass meter and connect voltmeter to the plug terminals 1(+) and 4(-). Repeat testing of self-cleaning function. A voltage must be measured instead of the hot wire glowing. Set value: approx. 5 V

Control unit is defective if no voltage is measured. Air-flow meter must be renewed if voltage attains set value.



- 1 = Hot-wire air-mass meter (HLM)
- 2 = Plug of HLM

Return to trouble-shooting chart B03

V

Check exhaust emissions (CO).

Measurement conditions:

Engine at operating temperature,
switch off electrical loads,
prescribed idle speed,
idle signal from EMS present,
automatic transmission on
N or P.

1. Vehicles with no catalytic
converter:

Connect exhaust analyzer to
tailpipe and determine CO.

SET VALUE: see brief
instructions

2. Vehicles with catalytic converter:

Measure CO ahead of catalytic
converter and at tailpipe
(perform test for both
cylinder banks).

CO downstream of catalytic
converter must be considerably
less than upstream of it,
otherwise the catalytic converter
is defective. Generally speaking,
values of about 0 vol. % CO
are measured at the exhaust tail-
pipe.

SET VALUES: see brief
instructions

Note:

Monitoring and basic adjustment
of the mixture are taken care
of by the adaptive Lambda control
(by way of Lambda sensor). There
is thus no need for any settings.

Set values O.K.?

Y

V

Return to trouble-shooting chart
B03

N>

1. Vehicles with no catalytic
converter:

Adjustment potential for
mixture (CO) at potentiometer
in air-mass meter.

Remove plug in air-mass meter.

Turn potentiometer in a
clockwise direction, CO increases
(injection time is extended).

Turn potentiometer in an anti-
clockwise direction, CO decreases
(injection time is shortened).

Note:

Injection-time adjustment
range:

Max. 0.6 ms.

Following adjustment,
fit new plug (refer to
microcard EE-00 for
part No.).

2. Vehicles with catalytic converter:

Check air-intake system and
exhaust system (in particular
ahead of Lambda sensor) for
leaks.

Lambda sensor defective.

Control unit defective.

If CO too high downstream
of catalytic converter:
Catalytic converter O.K.?

Refer to trouble-shooting chart
for further potential faults.

PARTS SET FOR SOLENOID-OPERATED

INJECTION VALVES 0 280 150 2..

AND PRESSURE REGULATORS 0 280 160 2..

supersedes 8.82 edition

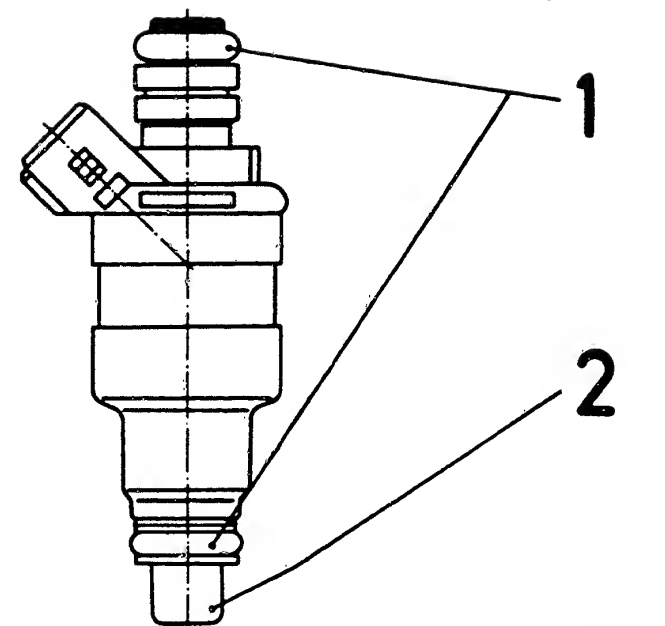
13...39
VDT-I-261/102 En
6.1983

A common parts set is available for the Motronic solenoid-operated injection valves and pressure regulators with the new method of connection.

Since the above-mentioned parts are subjected to extreme temperature stress, they should be exchanged for new parts whenever servicing is carried out.

"Unmetered air" sucked in through injection-valve seals which are not tight is a frequent case for servicing.

The parts set has the part number 1 287 010 704 and is listed in the service-parts microcard under solenoid-operated injection valves (see EE 00 under 0 280..).



280/a

1 = O-ring

2 = Protection sleeve

Contents for 1 injection valve:

2 x O-ring

1 x Protection sleeve, yellow

Contents for pressure regulator:

1 x O-ring

1 x Supporting plate

Published by:

ROBERT BOSCH GMBH

Division KH

Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

PLUG CONNECTORS FOR JETRONIC COMPONENTS

28
VDT-I-280/111 En
11.1984

Parts sets supersedes Ed. 11.1982

Parts sets are available for the replacement
of Jetronic plug connectors, comprising:

- * Plug-connector housing
- * Protective cap (rubber sleeve)
- * Contact springs

These parts are listed on microcard EE...*

- * See microcards EE00 and 0 280 ..

- * Plug, black, 2-pole,
parts set 1 287 013 002 cable connector
in conjunction with socket, 2-pole.

- * Socket, black, 2-pole,
parts set 1 287 013 001 for e.g.

Temperature sensor	0 280 130 0..
Auxiliary-air device	0 280 140 ..
Thermo-time switch	0 280 130 2..
Start valve	0 280 170 ..
Warm-up regulator	0 438 140 ..

- * Socket, gray, 2-pole,
parts set 1 287 013 003 for:

Injection valve 0 280 156 ..

- * Socket, black, 3-pole
parts set 1 237 000 039 for:

Throttle-valve switch 0 280 120 ..

- * Socket, black, 5-pole,
parts set 1 287 013 006 for:

Air-flow sensor 0 280 20. .. (LE version)

- * Socket, black, 6-pole,
parts set 1 287 013 004 for

Air-flow sensor 0 280 200 ..

- * Socket, black, 7-pole,
parts set 1 287 013 005 for:

Air-flow sensor 0 280 20. ..

Air-mass sensor 0 280 211 ..

- * Wiring-harness plug connector, black, 25-pole,
parts set 1 287 013 009 for:

Control unit 0 280 0..

- * Wiring-harness plug connector, black, 35-pole,
parts set 1 287 013 008 for:

Control unit 0 280 0..

The contact springs (minitimers) are also
available individually under part number
1 284 477 026.

The plug-connector housings are available
only in the stated colors.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments
concerning the contents to our authorized
representative in your country.

S E R V I C E I N F O R M A T I O N

VARIANT-CODED MOTRONIC CONTROL UNITS

Vehicles: passenger cars
05.1987

As of 06.86 in the case of 7 series and as of 10.86 in the case of the 6 series (5 and 3 series to follow) BMW has introduced a new generation of Motronic control units.

N E W

This type of control unit must be programmed to the appropriate vehicle type at KH b e f o r e delivery to the BG/BD.

N o t e :

The vehicle will not run with uncoded control units. Damage to the engine is possible with incorrectly coded control units.

In addition to the 10-digit part number, KH also requires the following details:

- (1) = Part number, 10-digit
- new (2) = Growth number,
3-digit (001 bis 999)
- new (3) = Variant control word, alphanumeric
4-position

Example:

- (1) = 0 261 200 150
 - (2) = 002
 - (3) = C05E
- (refer also to illustrations on following pages)

I M P O R T A N T :

Growth number (2) and variant control word (3) must be stated a d d i t i o n a l l y when ordering the control unit.

The control unit cannot be programmed without these details.

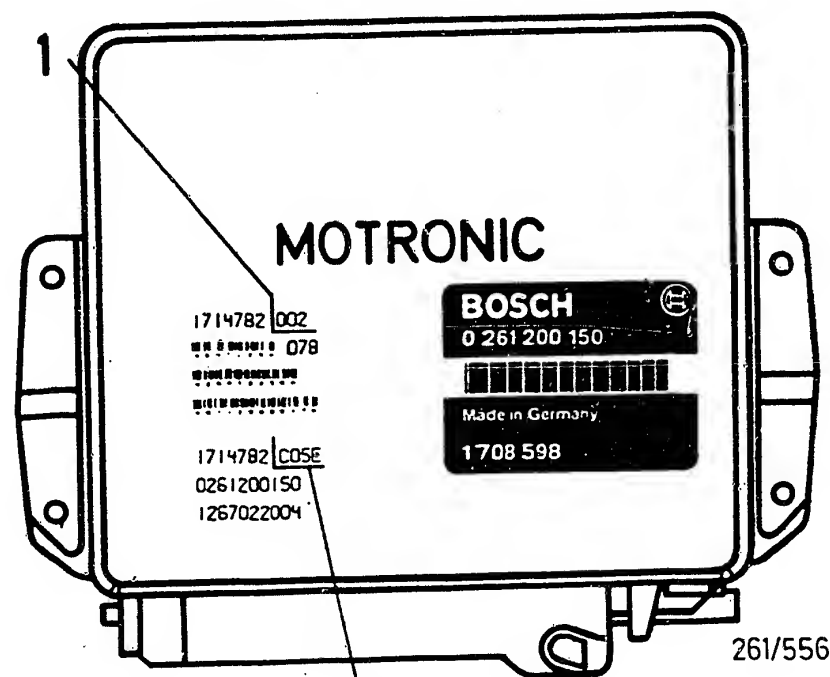
Types of control unit

0 261 200 150, old version, FD 645-651
0 261 200 150, new version, as of FD 652

0 261 200 151
0 261 200 152
0 261 200 153
0 261 200 154

Delivery procedure

- The variant-coded control units are stored at KH as central store parts.
- Delivery direct to orderer via overnight dispatch (within Fed. Republic of Germany).
- Delivery is delayed by one day due to the need to program the control units at KH.

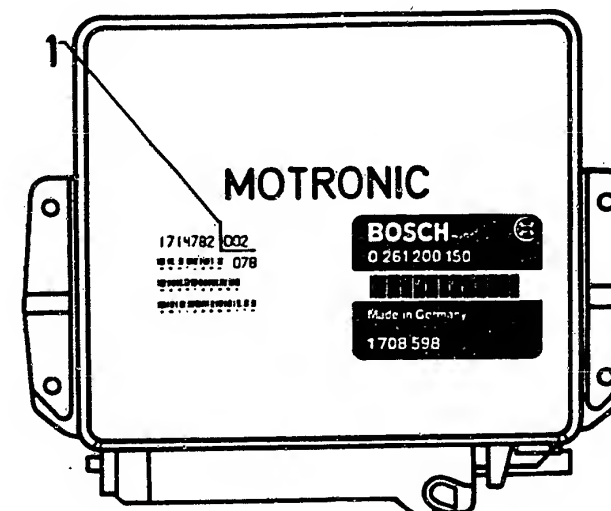


261/556

- 1 = Growth no. 3-digit
2 = Variant control word (code)
alphanumeric, 4-position

Motronic with variant coding

Control unit (only 0 261 200 150) old
version, FD 645-651.



261/557

- 1 = Growth no. 3-digit
2 = Variant control word (code)
alphanumeric, 4-position
3 = Chassis no.
4 = BMW sticker

Motronic with variant coding

Control units new version, as of FD 652.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments
concerning the contents to our authorized
representative in your country

INDEX

Coordinates

ABS/ETC/MSR control unit	B21
Accelerator-pedal switch.....	F05
Activation of self-diagnosis	B13
CO-content setting.....	F21
Diagnosis unit.....	B20
Driving-position switch.....	F07
Electric fuel pump.....	D26/E11
Electronic accelerator pedal.....	A03
EMS (see electronic accelerator pedal).....	—
Engine-mark signal.....	E23
Engine-speed/reference-mark sensor.....	D15
ETC action.....	C25
ETC interface.....	C23
Exhaust emissions.....	F21
Fault lamp.....	B09
Fault memory.....	B05/B15
Flashing code.....	B05
Fuel-injection signal.....	E21
Installation position of components.....	A13
Interference.....	E15
Interference-suppression resistors.....	F15
Leak test.....	E27
Pressure regulator.....	D25
Self-cleaning function.....	F19
Self-diagnosis.....	B09
Self-diagnosis test table.....	B16
Self-diagnosis trouble-shooting program.....	B19
Solenoid-operated injection valve.....	C13/E09/E13
Special features.....	A03
Stop-lamp/brake-safety switch.....	F05
Transmission action.....	D07
Trouble-shooting chart.....	B03
Trouble-shooting program.....	D15

INDEX (continued)

Coordinates

Air intake system.....	E25
Air-mass meter (see HLM).....	C01
Converter clutch.....	D13
Fuel delivery.....	E11
Fuel filter.....	E11
Fuel (leak test).....	E05
Fuel pressure.....	D25
Fuel pump relay.....	B23
Fuel pumps.....	B23
Full-load signal.....	E19
Ground terminals.....	A13
HLM (hot-wire air-mass meter).....	C01
High-tension sensor.....	A17
Hold circuit.....	A07
How to use microcard.....	A02
How to use self-diagnosis.....	B05
How to use trouble-shooting chart.....	B01
How to use trouble-shooting program.....	B01
Idle signal.....	E17
Ignition angle.....	F17
Ignition coil(s).....	F11
Ignition signal/primary signal.....	F13
Lambda sensor.....	C17
MSR interface.....	C23
Main relay.....	C21
Motronic control unit(s).....	A04
Overrun cutoff.....	F09
Pedal position sensor.....	B13
Pocket system tester.....	B05
Precautionary measures.....	A09
Primary signal.....	F13

INDEX (continued)

Coordinates

Pump noise.....	E11
Pump relay (see fuel pump relay).....	—
Safety measures.....	A09
Secondary patterns.....	F15
Self-test.....	B21
Sensor-heater relay.....	A04/A15
Tank ventilation system.....	A07/F01
Tank ventilation valve(s).....	B25
Temperature sensor (air).....	C27
Temperature sensor (engine).....	D03
Testers.....	A11
Tools.....	A11
Variant encoding.....	A03/A05
Voltage supply, control unit.....	C21

For production reasons:
continued on the following
coordinate.

TABLE OF CONTENTS

Section	Coordinates
Structure of this microcard.....	A01
How to use this microcard.....	A02
Special features.....	A03
Safety and precautionary measures.....	A09
Testers and tools.....	A11
Installation position of components.....	A13
How to use trouble-shooting chart and trouble-shooting program.....	B01
Trouble-shooting chart.....	B03
How to use self-diagnosis, self-diagnosis test table and self-diagnosis trouble-shooting program.....	B05
Self-diagnosis.....	B09
Self-diagnosis test table.....	B16
Self-diagnosis trouble-shooting program.....	B19
Trouble-shooting program.....	D15
Technical bulletins.....	N01
Index.....	N23

PUBLICATION INFORMATION

(c) 1989 ROBERT BOSCH GmbH Automotive Equipment -
After-Sales Service, Department of Technical
Publications KH/VDT, Postfach 10 60 50,
D-7000 Stuttgart 10.
Published by: After-Sales Service Department for Training
and Technology (KH/VSK).
Press date 06.1989.
Please direct questions and comments concerning the
contents to our authorized representative in your country.
This publication is only for the use of the Bosch After-
Sales Service Organization and may not be passed on to
third parties.

Microfilmed in the Federal Republic of Germany.
Microphotographié en République Fédérale d'Allemagne.